4.1 OPERATIONAL SAFETY/RISK OF ACCIDENTS

Section 4.1, Operational Safety/Risk of Accidents, of this Final Environmental Impact Report (EIR) for the Shell Martinez Marine Terminal (Shell Terminal) Lease Consideration Project (Project) describes those aspects of the existing environment that may impact operational safety, or that may be affected by an accident associated with the operation of the Equilon Enterprises LLC, doing business as (dba) Shell Marine Oil Terminal, including transportation of crude oil and petroleum products to and from the Shell Terminal. A summary of the existing vessel traffic levels and patterns and other marine terminals within the Bay Area, and a summary of the historical casualties involving tank vessels and marine terminals within the Bay Area, are provided. This is followed by a description of measures in place to allow the safe movement of marine vessels within the Bay, and to respond to emergency situations. Also included is a summary of laws and regulations that may affect the safety and potential risk from the facility and its operation. Finally, this section analyzes the potential for impacts and presents appropriate mitigation.

4.1.1 Environmental Setting

Bay Area and Shell Terminal Vessel Traffic

Bay Area

Many types of marine vessels call at terminals in the San Francisco Bay Area, including passenger vessels, cargo vessels, tankers, tow/tug vessels, dry cargo barges, and tank barges.

Lightering (transfer of oil from one vessel to another) takes place in Anchorage No. 9. Lightering is normally conducted from a large tanker, whose draft is too deep to allow it to call at a certain terminal with a full load, to a smaller tanker. Lightering has decreased in the Bay Area since the inception of air quality regulations requiring receiving vessels to be equipped with vapor recovery systems.

Table 4.1-1 presents information on vessel visits during ~~2004~~ 2003 and 2007/2008. The numbers in the table represent inbound transits. The number of outbound transits is essentially the same. A vessel that visits multiple terminals is counted at each terminal.

The Harbor Safety Committee of the San Francisco Bay Region, using data from the San Francisco Bay Region Marine Exchange, publishes information on tank vessel arrivals and movements in the Bay area. Table 4.1-2 summarizes these data and Tables 4.1-3 and 4.1-3a shows a breakdown by zone. Figure 4.1-1 shows the boundaries of the zones. As can be seen from Table 4.1-2, total tank vessel arrivals and movements increased slightly from 2003 to 2004 and from 2007 to 2008~~, while movements stayed approximately the same~~.

Figure 4.1-1. Tug Escort Zones

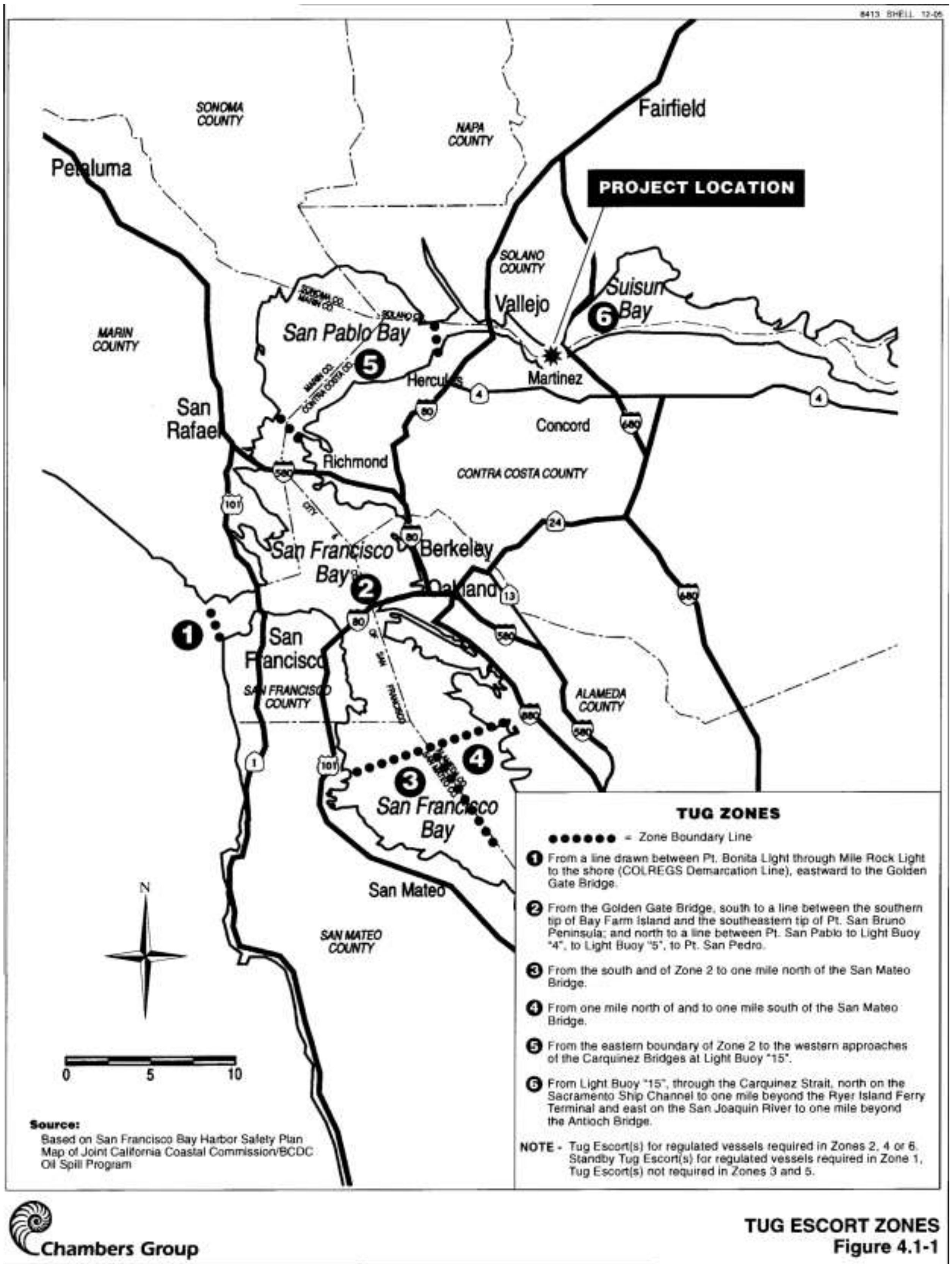


Table 4.1-1. 2003 & ~~2004~~ 2008 San Francisco Bay Inbound Vessel Traffic

Location	**Self-Propelled Vessels**		**Non-Self Propelled Vessels**			**Total Number of Vessel~~s~~ Visits**
	Passenger & Dry Cargo	**Tanker**	**Tow or Tug**	**Dry Cargo Barge**	**Tank Barge**	
2003						
San Francisco Bay Entrance	2,455	730	424	16	306	3,931
San Francisco Harbor	34,230[1]	16	542	161	67	35,016[1]
Redwood City Harbor	29	0	110	8	0	147
Oakland Harbor	9,218	3	1,401	262	352	11,236
Richmond Harbor	58	378	3,586	390	1,395	5,807
San Pablo Bay and Mare Island Strait	4,029	430	1,510	576	417	6,962
Carquinez Strait	254	416	1,602	511	318	3,101
Totals	**16,043[2]**	**1,957**	**8,633**	**1,763**	**2,788**	**31,184[2]**
2008						
San Francisco Bay Entrance	2,561	810	286	19	320	3,996
San Francisco Harbor	55,390[1]	4	612	171	67	56,244[1]
Redwood City Harbor	36	-	165	15	-	216
Oakland Harbor	12,523	28	1,876	325	633	15,385
Richmond Harbor	113	433	4,847	142	1,092	6,627
San Pablo Bay and Mare Island Strait	9,564	409	1,434	481	358	12,246
Carquinez Strait	957	392	1,362	282	292	3,285
Totals	**25,754[2]**	**2,072**	**9,970**	**1,264**	**2,695**	**41,755[2]**

Notes:

[1] Number of passenger and cargo vessels in Harbor reflects vessel traffic generated within the Bay, thus numbers shown exceed the number of vessels at the San Francisco Bay Entrance.

[2] Total excludes San Francisco Harbor passenger and cargo.

Sources:

U.S. Army Corps of Engineers (USACE) 2003. Waterborne Commerce of the United States Calendar Year 2003 Part 4-Waterways and Harbors Pacific Coast, Alaska, and Hawaii. ~~U.S. Army Corps of Engineers 2005. Waterborne Commerce of the United States Calendar Year 2004 Part 4-Waterways and Harbors Pacific Coast, Alaska, and Hawaii.~~

USACE 2008. Waterborne Commerce of the United States Calendar Year 2008 Part 4-Waterways and Harbors Pacific Coast, Alaska, and Hawaii.

* Data from 2008 (first full year available prior to release of this Final EIR) are provided for comparison purposes.

Table 4.1-2. 2003-2004 and 2007-2008 San Francisco Bay Tank Vessel Traffic

San Francisco Bay Region Totals	2003[1]	2004[1]	2007[2,3]	2008[2,3]
Tanker arrivals to San Francisco Bay	686	760	785	842
Tank ship movements and escorted barge movements	3,481	3,559	3,907	4,304
Tank ship movements	2,077	2,070	2,241	2,612
Escorted tank ship movements	1,026	1,016	1,121	1,241
Unescorted tank ship movements	1,051	1,054	1,120	1,371
Tank barge movements	1,404	1,489	1,666	1,692
Escorted tank barge movements	757	772	869	738
Unescorted tank barge movements	647	717	797	954

Sources:
[1] Harbor Safety Committee 2004.
[2] Harbor Safety Committee, San Francisco Bay Clearinghouse Report for 2008.
[3] Data from 2007 and 2008 (first full years available prior to release of this Final EIR) are provided for comparison purposes.

Table 4.1-3. Movements by Zone in 2004

Movements by Zone	Zone 1	Zone 2	Zone 4	Zone 6	Total
Total movements	2,298	3,398	0	1,694	7,390
Unescorted movements	1,056	1,722	0	801	3,579
Tank ships	702	1,046	0	425	2,173
Tank barges	354	676	0	376	1,406
Escorted movements	1,242	1,676	0	893	3,811
Tank ships	714	968	0	439	2,121
Tank barges	528	708	0	454	1,690

Notes:
[1] Information is only noted for zones where escorts are required.
[2] Every movement is counted in each zone transited during the movement.
[3] Total movements are the total of all unescorted movements and all escorted movements.
[4] See Figure 4.1-1 for a definition of the zones.

Source: Harbor Safety Committee, San Francisco Bay Clearinghouse Report for 2004.

Table 4.1-3a. Movements by Zone in 2008

Movements by Zone	Zone 1	Zone 2	Zone 4	Zone 6	Total
Total movements	2,498	4,045	0	2,010	8,553
Unescorted movements	1,279	2,179	0	1,066	4,524
Tank ships	923	1,364	0	530	2,817
Tank barges	356	815	0	536	1,707
Escorted movements	1,219	1,866	0	944	4,029
Tank ships	805	1,197	0	517	2,519
Tank barges	414	669	0	427	1,510

Notes:
[1] Information is only noted for zones where escorts are required.
[2] Every movement is counted in each zone transited during the movement.
[3] Total movements are the total of all unescorted movements and all escorted movements.
[4] See Figure 4.1-1 for a definition of the zones.

Source: Harbor Safety Committee, San Francisco Bay Clearinghouse Report for 2008.

* Data from 2008 (first full year available prior to release of this Final EIR) are provided for comparison purposes

Shell Terminal

Shell records indicate that during the 1994 to 2004 period, the Shell Terminal handled as many as 420 annual vessel calls at a volume of 48,300,000 barrels per year (bpy). Over the proposed lease period, the maximum capacity that the Shell Terminal could handle is 50,000,000 bpy, with increases expected from crude oil shipments rather than product deliveries. Depending on the size of the vessels (ships and barges), vessel traffic could reach up to 330 ships and barges per year. This number for vessel calls served as the basis for the impact analysis. Table 4.1-4 provides a summary of annual vessel calls at the Shell ~~Martinez MOT~~ Terminal from 1994 to 2004. ~~Table 4.1-4a provides a summary of the vessel volumes (in bpy) for the years 1994 to 2004~~.

Table 4.1-4. Vessel Calls and Wharf Receipts at the Shell Martinez Marine Terminal 1994-2004

Year	Vessel Calls			Wharf Receipts (volumes in barrels (bbls)		
	Tanker Calls	Barge Calls	Total Vessel Calls	Wharf Receipts (arriving vessels)	Wharf Deliveries (departing vessels)	Total Yearly Wharf Volumes (sum of both in bbls)
1994	171	241	420	8,876,763	34,619,143	43,495,879
1995	144	219	363	11,802,500	36,512,600	48,315,100
1996	137	208	345	10,142,300	21,082,128	31,224,428
1997	102	109	211	5,472,800	9,889,500	15,362,300
1998	117	130	247	6,414,600	1,314,900	7,729,550
1999	119	123	242	4,700,800	7,742,400	12,443,200
2000	111	182	293	5,336,836	7,654,269	12,991,105
2001	107	107	214	6,982,201	8,576,266	15,558,467
2002	110	59	169	6,191,009	8,802,625	14,993,009
2003	91	139	230	8,415,794	8,432,865	16,847,679
2004	54	134	230	13,821,217	8,805,576	24,393,097
Source: Shell, 2005.						

Outer Coast

Vessels entering and leaving the Golden Gate entrance to San Francisco Bay do so through the Traffic Separation Scheme (TSS), which consists of a circular Precautionary Area with three traffic lanes (northern, main or western, and southern) exiting from the Precautionary Area (refer to Figure 4.1-2). In a special one-time study, data compiled by the U.S. Coast Guard (USCG) Vessel Traffic Center (VTC) for November 1993 through July 1994, show that approximately 50 percent of the tankers used the western lane, while approximately 25 percent of the tankers used the north and south lanes, respectively. For all types of vessel traffic, approximately 25 percent used the west lane, while 37 percent used the north and south lanes, respectively. ~~This information is still considered current, as no follow up studies have been conducted.~~

Risk identification and mitigation are and have been ongoing activities within the USCG Sector San Francisco area of responsibility. In support of that overall safety improvement activity, a formal USCG-sponsored Port and Waterways Safety Assessment (PAWSA) for the San Francisco Bay area and significant tributaries was conducted in Oakland, California on August 12-13, 2008. The workshop was attended by 23 participants representing waterway users, regulatory authorities, and stakeholders (i.e., organizations with an interest in the safe and efficient use of San Francisco waterways for commercial and recreational purposes). A previous PAWSA for San Francisco was conducted in November 1999, and included a portion of the waterway addressed by the 2008 PAWSA.

The 2008 PAWSA for San Francisco concluded that risks were judged to be well balanced with existing mitigation measures, including existing vessel traffic management measures (PAWSA 2008).

Once outside the Golden Gate, limited information is available on vessel routes after they leave the traffic lanes. Table 4.1-54 presents information on possible tanker origins and destinations, and travel distances from the California coastline when calling at terminals in the San Francisco Bay. Tankers essentially remain at least 50 miles offshore when transiting to and from Alaska, and 25 miles offshore when transiting to and from other locations. Tank barges normally transit at least 15 miles offshore. Vessel calls to marine terminals in San Francisco Bay are shown in Tables 4.1-5 and 4.1-5a.

Table 4.1-5. Tanker Origin/Destination to/from San Francisco Bay and Distance Traveled From Coast

Origin	Destination	Typical Distance From Coast (Miles)
Alaska	SF Bay	50+
Canada	SF Bay	25+
Oregon and Washington	SF Bay	25+
Asia and Hawaii	SF Bay	NA
Los Angeles	SF Bay	25+
Mexico, Panama, and South America	SF Bay	10+
SF Bay	Oregon and Washington	25+
SF Bay	Humboldt Bay	25+
SF Bay	Asia and Hawaii	NA
SF Bay	Port San Luis	10+
SF Bay	Los Angeles	50+ ANS crude 25+ other crude and products
SF Bay	Mexico, Panama, and South America	25+

Sources: USCG and National Oceanic and Atmospheric Administration undated. Report to Congress on Regulating Vessel Traffic in the Monterey Bay National Marine Sanctuary as Required by Public Laws 102-368 and 102-587. San Francisco Bay Region Marine Exchange for 2002.

Table 4.1-5a. Vessel Calls to Marine Terminals in the San Francisco Bay During 2004 & 2008

Marine Terminal	Vessels	Barges	Total
2004[1]			
Shell Oil, Martinez	55	120	175
G.P. Resources	0	6	6
Tesoro Amorco	88	0	88
Tesoro Avon	41	87	128
ConocoPhillips, Rodeo	26	232	258
~~Pacific Atlantic~~ Plains Product Terminals LLC, Martinez	50	143	193
Shore, Selby	24	31	55
Chevron Long Wharf, Richmond	368	398	770*
BP West Coast, Richmond	1	22	23
~~Pacific Altantic~~ Plains Product Terminals LLC, Richmond	3	343	346
BP Lubricants	0	12	12
Kinder Morgan, Richmond	18	0	18
IMTT, Richmond	26	451	604*
ConocoPhillips, Richmond	0	31	31
Valero, Benicia	96	69	164*
Total all Terminals	796	1,945	2,871
2008[2]			
Shell Oil, Martinez	67	130	197
G.P. Resources	3	60	63
Tesoro Amorco	82	3	85
Tesoro Avon	30	80	110
ConocoPhillips, Rodeo	77	179	256
Plains Product Terminals LLC, Martinez	87	119	206
Shore, Selby	34	24	58
Chevron Long Wharf, Richmond	410	370	780
BP West Coast, Richmond	22	8	30
Plains Product Terminals LLC, Richmond	10	333	343
BP Lubricants	0	12	12
Kinder Morgan, Richmond	5	0	5
IMTT, Richmond	5	443	532*
ConocoPhillips, Richmond	0	177	177
Valero, Benicia	134	22	156
Total all Terminals	**966**	**1,960**	**3,010**

Notes: * Includes other types of vessels.
[1] 2004 total include 127 tugs not included in the vessels or barges categories
[2] 2008 total includes 84 tugs not included in the vessels or barges categories

Sources: California State Lands Commission, Marine Facilities Division, 2005 & 2009.

Data from 2008 are provided for comparison purposes.

Imported cargo and associated vessel calls are expected to triple from 1995 to 2020. Numbers taken from the Seaport Plan (Bay Conservation and Development Commission 1996) show a projected increase in imports from approximately 15 million metric tons to 44 million metric tons during this timeframe. These numbers reflect general cargo ports and terminals; commodities handled at proprietary terminals (including the Shell Terminal) are not included in these projections.

Vulnerable Resources

Vulnerable resources are those resources that could potentially be harmed by an accident or spill. These resources are addressed in Section 4.2, Water Quality, and Section 4.3, Biological Resources. Besides commercial vessel traffic in the Bay, a great deal of fishing and recreational boating traffic occurs, as well as ferry service. There were approximately 88,500 ferry/passenger vessel trips in the Bay Area in 2000 transporting approximately 6 million passengers (URS 2002). Currently there are approximately 6,200 ferry trips per month (Harbor Safety Committee 2005). There were approximately 16,500 boat berths in San Francisco Bay marinas in 2001 (URS 2002). Fishing and recreational boating are discussed in Section 4.4, Commercial and Sport Fisheries.

Tank vessels transiting between the Shell Terminal and the Bay entrance must pass beneath the Carquinez Bridge complex located at the western end of the Carquinez Strait. There are ~~three~~ two separate bridges, one suspension bridge (named the Alfred Zampa Memorial Bridge) completed in 2003 carrying southbound traffic, and one completed in 1958 carrying northbound traffic~~, and one completed in 1927 that is no longer being used~~. Since the new bridge is a suspension bridge, the channel opening and height restrictions are governed by the ~~two~~ older bridge~~s~~. The channel on each side of the center pier is 998 feet wide. The minimum vertical clearances are 146 feet through the north span and 134 feet through the south span at mean higher high water (MHHW).

The Shell Terminal is surrounded on the land side by the Shell Refinery. The Martinez Marina is located approximately 1,000 feet to the southwest. The nearest residence is located approximately 0.74 mile to the southwest of the Shell Terminal.

Bay Area and Shell Oil Spill Response Capability

Bay Area

All of the marine terminals and all vessels calling at the marine terminals are required to have oil spill response plans and a certain level of initial response capability. However, it is not economically feasible or practical for individual terminal operators and vessels to each have their own equipment to respond to more than minor spills. Therefore, operators must rely on pooled or contract capabilities.

The vessel and terminal owners use various companies and organizations to provide their response capability. The USCG and California Office of Spill Prevention and Response (OSPR, part of the Department of Fish and Game) have ~~has~~ created the Oil Spill Response Organization (OSRO) classification program so that facility and tank vessel operators can contract with and list an OSRO in their response plans in lieu of providing extensive lists of response resources to show that the listed organization can meet the response requirements. Organizations that want to receive a Coast Guard OSRO classification submit an extensive list of their resources and capabilities to the

Coast Guard for evaluation. The State of California has a similar OSRO classification program to allow facility and tank vessel operators to list OSROs in meeting State oil spill response requirements. OSROs currently listed in the Bay Area that provide on water services include National Response Corp., Clean Bay Inc. (CBI), Marine Spill Response Corporation (MSRC), and Foss Environmental Services.

CBI, an oil spill cooperative that was established for the Bay and outer coast areas, merged with MSRC on January 1, 2004. The MSRC is the largest, dedicated, standby oil spill response program in the United States, including open water, shoreline, and mid-continent river operations. MSRC response services are available to all Marine Preservation Association (MPA) members, companies that have contracted with MSRC, and on a reimbursable basis.

MSRC has an extensive inventory of response equipment located throughout the Bay Area including Berkeley, Concord, Crockett, ~~Marin,~~ Martinez, Oakland, Pittsburg~~h~~, Redwood City, Richmond, San Francisco (Pier 50), and Sausalito. Equipment located near Martinez is listed in Table 4.1-6.

Table 4.1-6. MSRC Martinez Spill Response Equipment

Equipment Type	Description
Response Boats	• Spill Spoiler I (90 barrels (bbls) storage, skimmer, boom) • Sentinel (90 bbls storage, skimmer, boom) • Mini Spoiler I (18 bbls storage, skimmer, boom) • Mini Spoiler II (18 bbls storage, skimmer, boom) • Boomer I (boom only)
Other Vessels	• 4 Mini Barges (100 bbls storage each) • 4 Shallow Water Push Boats • 2 Fast Tank (35 and 37 bbl storage) • 2 32’ Small Boats • 2 38’ Small Boats • 2 21’ Small Boats
Skimmers	• 2 Marco Class III (18,450 bpd Effective Daily Recovery Capacity) • 2 Marco Class I (7,176 bpd Effective Daily Recovery Capacity) • 1 6’ Oil Mop (240 bpd Effective Daily Recovery Capacity) • 1 W-4 (3,562 bpd Effective Daily Recovery Capacity)
Boom	• 4,000 ft 10” River Boom • 9,600 ft 20” Harbor Boom • 4,100 ft 43” Expandi 4300 • 1,100 ft 17” Amer B&B • 1,050 ft 20” Amer Marine • 2,000 ft 29” Parker • 2,500 ft 10” Cont Sys • 2,000 ft 8” Amer Marine • 2,000 ft Quali-Tech • 500 ft 16” Amer Fence • 200 ft 6” Amer Swamp
Source: MSRC 2005	

Shell Martinez

Shell is a member of ~~MSRC~~MPA. Shell also maintains spill response equipment at the Refinery and ~~marine~~ Shell Terminal. A list of this equipment is provided in ~~their~~ Shell's Oil Spill Response Plan (Shell 2004~~5~~) and summarized in Table 4.1-7. In addition, Appendix B of Shell's Oil Spill Response Manual lists oils spill response resources available from contractors.

Table 4.1-7. Shell Martinez Terminal Oil Spill Response Equipment

Type	Quantity	Make/Model	Location	Equipment Design
Spill Boom	2,600 ft.		Shell Terminal	30 minute deployment time
Sorbent Sweeps	30 Bundles		Oil Spill Warehouse	15 minute deployment time
Sorbent Pads	30 Bales		Oil Spill Warehouse	10 minute deployment time
Sorbent Pom-Poms	100 Boxes		Oil Spill Warehouse	10 minute deployment time
Boat	1	Boston Whaler	Shell Terminal Boat House	20 feet – 10 minute deployment time
Boat	1	Boston Whaler	Martinez Marina	26 feet – 10 minute deployment time
Boat	2	Aluminum Workboats	Shell Terminal Boat House	20 feet – 10 minute deployment time
Boat	1	Aluminum Workboats	On Trailer at Land's End	20 feet – 10 minute deployment time
Boat	2	Aluminum Workboats	Oil Spill Warehouse	Up to 16 feet – 10 minute deployment time
Source: Shell Martinez Refinery Oil Spill Response Plan, 2005.				

Federal and State regulations specify response capability requirements for marine facilities. In ~~response to~~ compliance with these regulations, Shell was required to submit an oil spill response manual which included calculations to establish a worst-case discharge (WCD) from the Shell Terminal and to show how and with what assets Shell would respond to such a spill. WCD calculations are required by the U.S. Environmental Protection Agency (EPA), USCG, and OSPR regulations. Shell is also required to calculate maximum most probable and average most probable release sizes for response planning in its Oil Spill Response Plan.

- The EPA WCD equals the contents of the largest onshore tank, which is 280,000 bbls. The storage tanks are not on the California State Lands Commission's (CSLC) lease or part of the Shell Terminal, however, responses to these size spills are presented in Shell's Oil Spill Response Plan.
- The USCG and OSPR WCD is the contents of the pipeline plus pumping loss for each oil group, and equates to 9,180 bbls. The pipelines are on the CSLC lease.
- Note that the EPA WCD volume is considerably greater than the USCG/OSPR WCD volume.

CSLC regulations require that all onshore marine terminals, except those "subject to high velocity currents," be able to deploy a boom in a specified manner to enclose the water surface surrounding the vessel prior to transfer operations. An "onshore marine terminal subject to high velocity currents" is defined as an onshore terminal at which the maximum current velocities are 1.5 knots (nautical miles [nm]/hour) or greater for the majority of the days in the calendar year. The Shell Terminal fits into this category. Instead, under California Code of Regulations (CCR) section 2395(c)(4), onshore marine terminals subject to high velocity currents must provide sufficient boom appropriate to the conditions at the terminal, trained personnel, and equipment maintained in a standby condition at the berth for the duration of the entire transfer operation, so that a length of at least 600 feet of boom can be deployed within 30 minutes of a spill. Shell maintains 2,000 feet of boom on the Shell Terminal that can be deployed within 30 minutes. Boom deployment at the Shell Terminal is discussed in more detail in Section 4.1.4.1, Spill Response Capability and Potential for Public Risk at the Shell Terminal, under Impact OS-3.

The USCG requires that marine terminals must be able to respond to a small (50 bbls) spill with the following equipment:

- 1,000 feet of containment boom and a means of deploying it within 1 hour;
- Oil recovery devices within 2 hours; and
- Oil storage capacity for recovered oily material.

Spills from Bay Area Marine Terminals and Shell Terminal/Refinery

Bay Area

The CSLC has been tracking spills from marine terminals throughout the State since 1992. A total of 159 spills bay-wide, varying from 1 gallon (or less) to 1,092 gallons (26 bbls), occurred during the 14 years from 1992 through 2005. This equates to approximately 11 spills per year or one spill every 247 vessel calls. This is based on the assumption that the annual number of tank vessel calls to marine terminals in the Bay Area from 1992 through 2005 has remained about the same in later years, averaging approximately 2,800 tank vessel calls per year. This is based on data contained in Appendix C of the Unocal San Francisco Refinery Marine Terminal EIR (Chambers Group 1994), which showed the number of tank vessel calls in 1992 was 2,871, and the CSLC data, which show~~ed~~ that there were 2,738 tank vessel calls in 1998, ~~and~~ 2,873 tank vessel calls in 2004, and 3,010 tank vessel calls in 2008.

Terminals were the responsible party for approximately 59 percent of the spills, while vessels were responsible for the remaining 41 percent.

There is a 0.71 percent reduction factor in tanker and barge collisions for double-hull vessels. The corresponding assumptions for tanker and barge spill probabilities are presented in Section 4.1.4.2, Accidents and Safety Risk within the Bay and Outer Coast.

Shell Terminal

Shell reported in ~~their~~ its Oil Spill Response Plan that there have been five spills of over 1 barrel since April 1984. These spills are described below.

- November 16, 1984 – Approximately 25 bbl release of oil/water from a section of retired ballast line as it was being removed. In response to this release Shell instituted procedures to ensure that lines are empty and purged before being removed.
- January 27, 1987 – Approximately 25 bbl release from a steam traced asphalt pipeline. In response to this accident, the entire pipeline was replaced.
- February 6, 1989 – Approximately one barrel of cutter stock was released from a pinhole leak in a pipeline on the Shell Terminal. In response to this release, the entire pipeline was checked using ultrasonic testing.
- December 1, 2005 – Shell experienced a small spill resulting from corrosion in a product pipeline segment from the trestle to Berth #1. Shell immediately repaired this segment by inserting a blind and a gasket on the Berth #1 side to the “T” (this line extends from shore to a “T” under the wharf; and then extends from the “T” to each berth). Following this repair, the pipeline segment from the “T” to Berth #2 was returned to normal operations, while the blinded segment from the “T” to Berth #1 was not, pending a later repair scheduled the following year.
- January 2, 2006 – Heavy rain during transfer of ~~VGO (~~viscous gas oil~~)~~ (VGO) to a barge at Berth #1 contributed to an overflow of a drip pan via a protective pan sleeve. Upon discovery of oil in the water, Shell staff implemented ~~their~~ its oil spill response operations and immediately terminated operations. Shell investigated this incident and determined that the oil had leaked from the blank flange connection that had been installed on ~~12/1/~~ December 1, 2005. The cause was apparently due to a failure of the gasket. The oil leaked into the drip collection pan, already full of rainwater, and the pan overflowed into the Bay.

  Following this incident Shell conducted, in collaboration with the California OSPR and the CSLC, a complete review of the incident, examining contributing factors, including Human Occupational Errors (HOE) and the existing condition/capacity of equipment. Shell repaired the sump system, inspected, cleaned and recoated the drip pans, replaced level switches with model upgrades, modified the operational guidelines and conducted staff awareness training to prevent any future occurrence of a similar incident. All procedural and maintenance-related corrective actions were completed by the end of 2006. ~~The remaining items, related to potential upgrade of the sump pumps and instrumentation, are currently in the engineering, review, and approval process.~~ The Shell Terminal sump systems were upgraded in 2008.

Shell Martinez Refinery

Although the two onshore tank-related Shell Refinery spills listed below differ from a tanker or terminal spill because they originated within the manufacturing complex, the spills reached an adjacent marsh and/or Bay waters and demonstrate the extent of spill impacts and magnitude of cleanup efforts for spills of similar size.

- On April 22 and 23, 1988, a leaking tank at the Shell Refinery in Martinez drained approximately 400,000 gallons (9,524 bbls) of crude oil into a nearby creek, under the freeway, and down into a 100-acre marsh (now called McNabney Marsh). Oil filled the marsh to a depth of more than four inches before flowing under the railroad tracks, past the Refinery, into the Carquinez Strait, upstream into Suisun Bay, and downstream on the next tide into San Pablo Bay.

  Many federal, state and local agency personnel, oil company representatives, cleanup contractors, scientists and others responded to the spill. In an attempt to recover as much oil from the surface of the water as possible, Clean Bay, an oil company cooperative, dispatched skimmers, and Shell and USCG personnel placed oil boom and sorbent materials. After as much floating oil as possible was removed, cleanup of residues on shorelines began. Pump trucks sucked pooled oil from the McNabney Marsh, and Shell workers spread and retrieved sorbant boom, pom-pom, and pads. Cleanup of waterfront areas in Martinez and Benicia involved the use of high-pressure water washing to mobilize deposited oil and sorbant pads to recover it. This initially had only limited success, but in the end proved to be quite effective. The McNabney Marsh was ultimately drained, and contaminated vegetation was cut and removed by small crews using hand tools. (Shell Oil Spill Restoration Final Report, 1990-2001.)

- On April 12, 1994, 10 bbls of diesel fuel were released into Carquinez Strait because of a failure of a pipeline relief valve system, resulting in overflow of the stop storage tank.

Other Major Vessel Incidents

Over the past 35 years, several incidents involving vessels have drawn public attention.

- In 1971, a collision of the Oregon Standard and the Arizona Standard under the Golden Gate occurred in heavy fog and resulted in the spillage of approximately 27,600 bbls of bunker heavy fuel oil. Spilled oil impacted the outer coast to the north as far as Double Point (north of Point Reyes Bird Observatory) in Marin County, and to the south near San Gregorio Beach in San Mateo County, as well as within San Francisco Bay. Approximately 4,000 seabirds died as a result of the spill. This incident led to the Bridge to Bridge Radiotelephone Act, which requires all vessels to monitor Channel 14 VHF-FM and the development of the Vessel Traffic Service (VTS) in San Francisco Bay.

- In 1984, the chemical tanker Puerto Rican experienced an explosion in a void space surrounding a cargo tank while the vessel was in open waters about 8 miles west of the Golden Gate Bridge. The accident resulted in injury to crew members and the release of over 30,000 barrels of lubricating oil and fuel oil, impacting the Farallon Islands, Point Reyes, and Bodega Bay.

- In 1989, the tug Standard IV with an oil barge in tow lost control while approaching its berth at the Richmond Long Wharf. The barge struck the pier, destroying a catwalk and parting the bow lines on the tanker “Overseas Juneau.” The tanker’s bow began to swing away from the pier. The tanker dropped an anchor and hailed a passing light tug. The tug held the tanker’s bow against the dock while it made preparations to get underway. The tanker transited to anchorage without any further damage. The barge suffered minor damage and the tug none.

- The partially laden T/V Overseas Philadelphia was moored portside at the Wickland Selby marine oil terminal during the afternoon hours of February 20, 1997, when the vessel broke loose from her mooring lines and drifted without power into the Carquinez Strait. As a result, the terminal sustained severe damage to the fixed loading arms and the concrete wharf. Reportedly, 420 gallons of jet fuel was released into the Strait. The cause may have been due to a surge from the passing of another vessel that caused the breast lines to part and allowed the vessel to swing outward away from the dock. Since no cargo transfer operations were in process at the time of the incident, the spilled contents consisted of jet fuel remaining in the loading arms. Within approximately 8 minutes of the incident, the drifting vessel started her engines and then safely anchored approximately one nm from the Wickland Selby terminal.
- The Singapore-flagged Neptune Dorado was detained in San Francisco on September 24, 2000, by the USCG after port State inspections revealed safety deficiencies. The four safety deficiencies cited were two inoperative main fire pumps, a leaking starboard boiler oil settling tank, inoperative main vent blowers for the engine room, and leaking fuel oil lines to the main diesel engine. The vessel was allowed to proceed to a terminal and offload its cargo of crude oil in early October after repairs were made.
- In November 2007, a container ship, the Cosco Busan, struck the Bay Bridge and released almost 1,400 bbls of fuel oil into the water. Oil contamination occurred on the waterfront in the Bay, and several beaches in San Francisco and in Marin County were closed due to the oil. On-water and shoreline cleanup activities were undertaken, and many oiled beaches have since been cleaned up and have re-opened. As a result of this spill, State legislation was passed in September 2008 that is geared to improve oil spill preparedness and response measures, including assigning responsibility for cleanup in the event of a spill.

Other Relevant Spill Incidents

The BP Deepwater Horizon Oil Spill in the Gulf of Mexico resulted from the Deepwater Horizon drilling rig explosion on April 20, 2010. A well being drilled at the time released oil from several locations along the drill pipe. Response efforts included attempts to cap or contain the well, activate the blow-out-preventer that failed to activate and shut-in the well during the accident, inject dispersants into the plume of oil sub-sea, deploy booms and skimmers over large areas of the Gulf of Mexico, and drill two relief wells. The leak continued for at least three months and was the largest spill in U.S history. Estimates of the release volume range from 90 million to 179 million gallons (2.1 to 4.2 million bbls) (the estimates vary considerably because it was difficult to accurately estimate the flow

<u>of oil from the underwater pipes). By mid-July, about 484 miles of shoreline along the Gulf Coast were oiled, including Louisiana (287 miles), Mississippi (71 miles), Alabama (62 miles), and Florida (86 miles). Approximately 37 percent of Gulf of Mexico federal waters were closed for fishing, extending almost 250 miles east, west, and south of the release location. About 3 million feet of containment boom and 5.4 million feet of sorbent boom were deployed to contain the spill, and more than 6,900 vessels responded to the site, including skimmers, tugs, barges, and recovery vessels.</u>

<u>Although the BP spill differs from a tanker spill since it was in very deep waters, the release location was at the ocean floor, and it continued for a period of 100 days, the extent of spill impacts gives a measure to the extents that are estimated in this EIR's modeling analysis and demonstrates the extent of spill impacts.</u>

Factors Affecting Vessel Traffic Safety

This section summarizes environmental conditions described in the USCG <u>Coast</u> Pilot, <u>(</u>Volume 7, 37th Edition, 2005<u>)</u>, the San Francisco, San Pablo and Suisun Bays Harbor Safety Plan Year 2002 (Harbor Safety Committee 2002), and San Francisco Bar Pilots Operations Guidelines for the Movement of Vessels on San Francisco Bay and Tributaries that could have an impact on vessel safety in the Bay Area. More detailed information on many of the areas can be found in the existing conditions description of other sections, e.g., detailed meteorological data can be found in Section 4.6, Air Quality.

Winds

Bay Area weather is seasonably variable with three discernible seasons, for marine purposes, as discussed below.

- <u>Winter Winds</u>. Winter winds from November to February shift frequently and have a wide range of speeds depending on the procession of offshore high- and low-pressure systems. Overall, calms occur between 15 and 40 percent of the time inside the Bay, and 10 to 12 percent outside the Bay. Extreme wind conditions of 50 knots gusting to 68 knots have occurred during the winter. The strongest winds tend to come from the southeast to southwest ahead of a cold front.
- <u>Spring Winds</u>. Spring tends to be the windiest season, with average speeds in the Bay of 6 to 12 knots. Extremes are less likely than during the winter, but wind speeds from 17 to 28 knots occur up to 10 percent of the time. The approaches to the Golden Gate receive heavier weather and may experience 17- to 28-knot winds up to 40 percent of the time. Wind direction stabilizes as the Pacific High Pressure System becomes the dominant weather influence. Northwesterly winds are generated and reinforced by the sea breeze. Inside the Bay, winds are channeled and vary from northwest to southeast.
- <u>Summer Winds</u>. Summer winds are the most constant and predictable. The winds outside the Golden Gate are normally from northwest to north and are generated by the strong Pacific High. This condition lasts through October until

the system weakens and the winter cycle starts again. Winds inside the Bay are local depending on the land contours acting on the onshore flow. One of the few occurrences that will alter this pattern is when a high-pressure system settles over Washington and Oregon. When that happens, a northeast flow develops, bringing warm, dry air with it. This will clear away the summer fog, but also will dry the landscape and increase fire dangers.

Fog

Fog is a well-known weather condition in the Bay Area, particularly around the Golden Gate. It is most common during the summer, occasional during fall and winter, and infrequent during spring. The long-term fluctuations are not predictable, but daily and seasonal cycles are.

- Summer Fog. Summer fog depends on several conditions. The Pacific High becomes well established off the coast and maintains a constant northwest wind. It also drives the cold California Current south and causes an upwelling of cold water along the coast. Air closest to the surface becomes chilled so that the temperature increases with altitude. This forms an inversion layer at about 500 to 1,500 feet. Moist, warm ocean air moving toward the coast is cooled first by the California Current, then more by cold coastal water. Condensation occurs and fog will form to the height of the inversion layer. This happens often enough to form a semi-permanent fog bank off the Golden Gate during the summer. Under normal summer conditions, a daily cycle is evident. A sheet of fog forms off the Golden Gate headlands during the morning and becomes more extensive as the day passes. As the temperatures in the inland valleys rise, a local low pressure area is created, and a steady indraft takes place. By late afternoon, the fog begins to move through the Golden Gate at a speed of about 14 knots on the afternoon sea breeze. Once inside the Bay, it is carried by local winds. In general, the north part of the Bay is the last to be enveloped and the first to clear in the morning. The flow is so strong at times that the sea fog penetrates to the east as far as Sacramento and Stockton. If it continues for a few days, cooler ocean air replaces the warm valley air and causes the sea breeze mechanism to break down. Winds diminish and the Bay Area clears for a few days. Slowly the valley reheats and starts the cycle again.

- Winter Fog. Winter fog is usually radiation fog or “tule” fog. With clear skies and light winds, land temperature drops rapidly at night. In low, damp places, such as the Delta and Central Valley (where tules and marsh plants grow), this results in a shallow radiation fog (moist sea air reacting to cold land mass) that may be quite dense. In contrast to the summer fog that moves from sea to land at about 14 knots, the winter tule fogs move slowly seaward at about 1 knot.

Currents

The currents at the entrance to San Francisco Bay are variable, uncertain, and at times attain considerable velocity. Immediately outside the bar is a slight current to the north and west known as the Coast Eddy Current. The currents that have the greatest effect on navigation in the Bay and out through the Golden Gate are tidal in nature.

In the Golden Gate, the flood or incoming current sets (direction of flow) straight inward (east) with a slight tendency to the north shores, and with heavy turbulence at both Lime and Fort Points when the flood is strong. This causes an eddy or circular current between Point Lobos and Fort Point.

The ebb or outgoing current has been known to reach more than 6.5 knots between Lime and Fort Points. Its general set is westward. As with the flood current, it causes eddies between Point Lobos and Fort Point. A heavy rip and turbulence extend to 0.25 mile south of Point Bonita.

In the Golden Gate, the maximum flood current occurs about 1.5 hours before high water, with the maximum ebb occurring about 1.5 hours before low water. The average current velocities are 3 knots for the flood and 3.5 knots for the ebb.

The flood sets to the northeast and causes swirls and eddies. This is most pronounced between the Golden Gate, Angel Island, and Alcatraz Island. The current sets through Raccoon Strait (north of Angel Island), taking the most direct path to the upper Bay and the Delta area. The ebb current inside the Golden Gate is felt on the south shore first. The duration of the ebb is somewhat longer than the flood due to the addition of runoff from the Sacramento and San Joaquin River systems.

Tides

Tides in the San Francisco Bay Area are mixed. Usually two cycles of high and low tides occur daily, but with inequality of the heights of the two. Occasionally, the tidal cycle will become diurnal (only one cycle of tide in a day). As a result, depths in the Bay are based on mean lower low water level (MLLW), which is the average height of the lower of the two daily low tides. The mean range of the tide at the Golden Gate is 4.1 feet, with a diurnal range of 5.8 feet. During the periodic maximum tidal variations, the range may reach as much as 9 feet and have lowest low waters 2.5 feet below MLLW datum.

Water Depths

Water depth in the Bay Area is generally shallow and subject to silting from river runoff and dredge-spoil recirculation. Therefore, channel depths must be regularly maintained and shoaling must be prevented in order to accommodate deeper draft vessels. The USACE tries to maintain the depth of the main ship channel from the Pacific Ocean into the Bay at 55 feet; however, the continual siltation creates main channel depths ranging between 49 and 55 feet. Deep draft vessels in the Bay must carefully navigate many of the main shipping channels because channel depths in some areas are barely sufficient for navigation by some modern larger vessels, especially when deeply laden. While the USACE surveys specific areas of concern on a frequent basis, recent survey charts may not show all seabed obstructions or shallow areas due to highly mobile bottoms (due to localized shoaling). In addition, recent observations indicate that manmade channels may influence tidal currents to a greater degree than earlier anticipated. Additional information on water depth and quality at the Shell Terminal is found in Section 4.2, Water Quality.

Bay Area Vessel Traffic Control Systems

Navigational Description

A Traffic Separation Scheme (TSS) has been established by the USCG off the entrance of San Francisco Bay. It includes three directed traffic areas, each with one-way inbound and outbound traffic lanes separated by defined separation zones, a and Precautionary Area~~, and a pilot boat cruising area~~. The TSS is recommended for use by vessels approaching or departing the Bay, but is not necessarily intended for tugs, tows, or other small vessels that traditionally operate outside the usual steamer lanes or close inshore. This TSS has been adopted by the International Maritime Organization (IMO). Figure 4.1-2 depicts the TSS area and navigation aids.

There are seven regulated navigation areas (RNAs) in San Francisco Bay. The USCG established these RNAs in 1993 with input from the Harbor Safety Committee based on the voluntary traffic routing measures that were previously in existence. The RNAs are codified in 46 Code of Federal Regulations (CFR) 165.1116. RNAs organize traffic flow patterns to reduce vessel congestion where maneuvering room is limited; reduce meeting, crossing, and overtaking situations between large vessels in constricted channels; and limit vessel speed. The seven RNAs are shown in Figure 4.1-3. All vessels 1,600 gross tons or more and tugs with a tow of 1,600 gross tons or more (referred to here as large vessels) navigating in the RNAs are required by the regulations to:

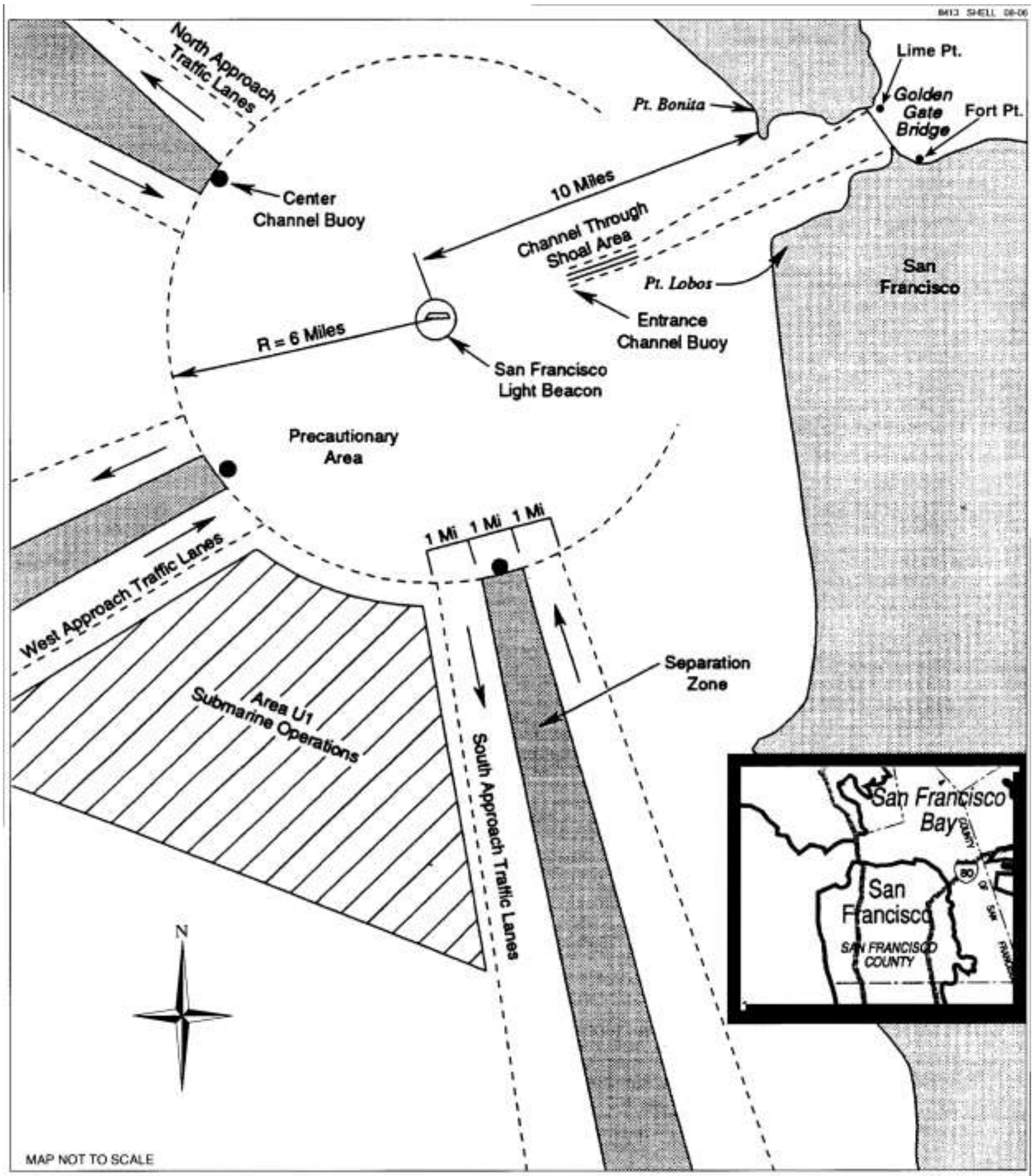
- Not exceed a speed of 15 knots through the water;~~, and~~
- Have engine(s) ready for immediate maneuver; and
- ~~o~~Operate engine(s) in a control mode and on fuel that will allow for an immediate response to any engine order.

Each of the seven RNAs are described below:

San Francisco Bay RNA	The San Francisco Bay RNA consists of the water area in the Golden Gate east of the International Regulations for Preventing Collisions at Sea (COLREGS) Demarcation Line (33 CFR 80.1142), the Central Bay including Raccoon Strait, and the existing charted Precautionary Area east of Alcatraz Island (Figure 4.1-3). Traffic lanes have been established in this RNA to separate opposing traffic and reduce vessel congestion. Because of shoals and rocks in the Central Bay, the Central Bay Two-way Deep Water Traffic Lane (DWTL) north of Harding Rock~~,~~ provides the best water depth safety margin for inbound vessels with a draft of 45 feet or greater, and for outbound vessels with a draft of 28 feet or greater.

San Francisco Bay RNA (continued)	Such deep draft vessels are required to use the DWTL. All other vessels are encouraged to use the Central Bay Traffic Lanes so that vessel traffic in the DWTL is kept to a minimum. Regulations prohibit a large vessel from entering the DWTL when another large vessel is navigating therein and when either vessel is carrying certain dangerous cargo (as defined in 33 CFR 160.203), bulk petroleum products, or is a tank vessel in ballast, if such entry could result in meeting, crossing, or overtaking the other vessel. Because vessels are converging or crossing in such a manner that one-way traffic flow patterns cannot be established, there are two Precautionary Areas in the RNA: (1) the Golden Gate Precautionary Area, which encompasses the waters around the Golden Gate between the Golden Gate and the Central Traffic Lanes; and (2) the Central Bay Precautionary Area, which encompasses the large portion of the central bay and part of the lower bay. It is recommended that all vessels navigating in these Precautionary Areas be aware of the joining lanes and DWTL so as to anticipate the movements of the other vessels.
Oakland Harbor RNA	The Oakland Harbor RNA encompasses the Oakland Bar Channel, Oakland Outer Harbor Entrance, and Middle Harbor and Inner Harbor Entrance Channels. Large vessels are prohibited from entering the RNA if they could meet, cross, or overtake another large vessel.
Southampton Shoal Channel/ Richmond Harbor RNA	This RNA encompasses Southampton Shoal Channel, the Richmond Long Wharf Maneuvering Area, the Richmond Harbor Entrance Channel, and Point Potrero Reach (Figure 4.1-3). These are dredged channels and areas within which maneuvering room is severely limited. In addition, the Southampton Shoal Channel is transited by a high number of laden tank vessels, and vessels carrying dangerous cargo or bulk petroleum. Large vessels are prohibited from entering the RNA if they could meet, cross, or overtake another large vessel.
North Ship Channel RNA and San Pablo Strait Channel RNA	Both these RNAs consist of the existing charted channels and delineate only the areas where the depths of water are sufficient to allow safe transit of large vessels. The existence of strong tidal currents in these channels severely restricts the ability of large vessels to safely maneuver to avoid smaller vessels. The general regulations apply to these areas; however, the addition of special regulations is not justified at this time.
Pinole Shoal Channel RNA	This RNA is a constricted waterway, the use of which is currently restricted to vessels and tows 1,600 gross tons or more (called large vessels). Regulations prohibit a large vessel from entering the Pinole Shoal Channel when another large vessel is navigating therein and when either vessel is carrying certain dangerous cargo, bulk petroleum products, or is a tank vessel in ballast, if such entry could result in meeting, crossing, or overtaking the other vessel.
Benicia-Martinez Railroad RNA	This RNA consists of a small circular area, 200 yards in radius, centered on the middle of the channel under the Benicia-Martinez Railroad Bridge that spans the Carquinez Strait between Benicia and Martinez. Because of the limited horizontal clearance of the bridge, large vessels are prohibited from transiting this RNA when visibility is less than 0.5 nm. The proposed Project is located within this RNA, just east of the map shown on Figure 4.1-3.

Figure 4.1-2. Offshore Traffic Separation Scheme



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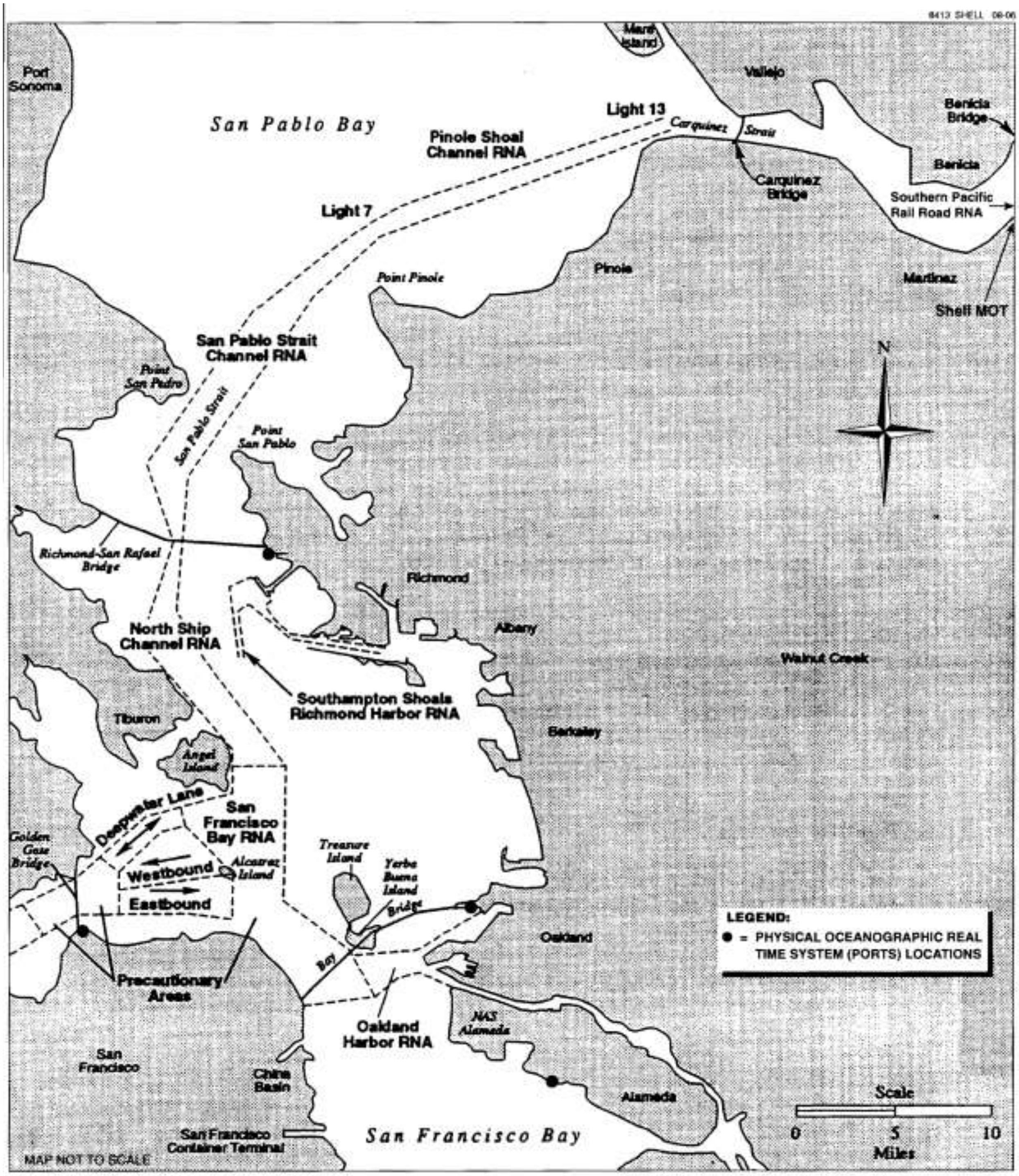
OFFSHORE TRAFFIC SEPARATION SCHEME
Figure 4.1-2

1 Figure 4.1-3. Regulated Navigation Areas



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REGULATED NAVIGATION AREAS
Figure 4.1-3

Position Reporting, Communication, and Surveillance

The USCG VTS at Yerba Buena Island is the communications center for the TSS. The TSS was extensively upgraded in 1997. The upgraded system includes state-of-the-art computer digitized radar displays shown on electronic charts. The new system automated many of the controller's duties, allowing more time for monitoring traffic.

Pilotage

Pilotage in and out of the San Francisco Bay and adjacent to the waterways is compulsory for all vessels of foreign registry and United States vessels under enrollment not having a federally licensed pilot on board. The San Francisco Bar Pilots provide pilotage to ports in San Francisco Bay and to ports on all tributaries to the Bay. Pilots board the vessels in the Pilot Boarding Area outside the Golden Gate entrance, and then pilot the vessels to their destinations. Pilots normally leave the vessels after docking and reboard the vessels when they are ready to leave and pilot them to sea or other destinations within the Bay Area.

Navy pilots operate military vessels and Military Sealift Command (MSC) vessels. The MSC vessels are normally boarded in the Pilot Boarding Area outside the Golden Gate entrance. The military vessels are boarded either outside the Golden Gate entrance or inside the Bay.

Physical Oceanographic Real Time System

The Physical Oceanographic Real Time System (PORTS) was installed in the Bay Area in 1995 with OSPR assuming overall responsibility for the system in 1998. The PORTS is designed to provide crucial information in real time to mariners, oil spill response teams, managers of coastal resources, and others about San Francisco Bay's water levels, currents, salinity, and winds. In partnership with the National Oceanic and Atmospheric Administration (NOAA), National Ocean Service (NOS), California OSPR, the USGS, and the local community, the Marine Exchange operates PORTS as a service to those who must make operational decisions based on oceanographic and meteorological conditions in the Bay. PORTS stations are located at the Golden Gate entrance, Redwood City, Alameda, Oakland, Richmond, Benicia, Martinez, Port Chicago, and Grizzly Bay.

The instruments that collect the information are deployed at strategic locations in the Bay to provide data at critical locations, and to allow casting and forecasting using a mathematical model of the Bay's oceanographic processes. Data from the sensors are fed into a central collection point; raw data from the sensors are integrated and synthesized into information and analysis products, including graphical displays of PORTS data. These displays are available over the Internet and through a voice response system. ~~PORTS is currently experiencing severe communications problems that will require major system upgrades (NOAA 2005).~~

4.1.2 Regulatory Setting

Many laws and regulations are currently in place to regulate marine terminals, vessels calling at marine terminals, and emergency response/contingency planning. Responsibilities for enforcing or executing these laws and regulations fall to various international, Federal, State, and local agencies. The various agencies and their responsibilities are summarized below.

International Maritime Organization (IMO)

The major body governing the movement of goods at sea is the IMO, which does so through a series of international protocols. Individual countries must approve and adopt these protocols before they become effective. The International Convention for the Prevention of Pollution from Ships as modified by the Protocol of 1978 (MARPOL~~)~~ 73/78 and amendments) governs the movement of oil and specifies tanker construction standards and equipment requirements, such as the following.

- Regulations 20 and 21 of Annexure I of MARPOL 73/78 require that tank vessels of deadweight (capacity) greater than 5,000 metric tons must be built with double hulls that provide an additional layer of protection.
- Regulation 37 ~~26~~ of Annexure I of MARPOL 73/78 requires that every tanker of 150 tons gross tonnage and above shall carry on board a shipboard oil pollution emergency plan approved by IMO.

The U.S. implemented MARPOL 73/78 with passage of the Act of 1980 to Prevent Pollution from Ships. The IMO (IMO 1992) has also issued “Guidelines for the Development of Shipboard Oil Pollution Emergency Plans” to assist tanker owners in preparing such plans that comply with the cited regulations and to assist governments in developing and enacting domestic laws which give force to and implement the cited regulations. Plans that meet the 1990 Oil Pollution Act (OPA 90) and the Lempert-Keene-Seastrand Oil Spill Prevention and Response Act (California Senate Bill [SB] 2040) requirements also meet IMO requirements. TSSs must be approved by the IMO, such as the approved TSSs off the entrances to San Francisco Bay and the Santa Barbara Channel.

The IMO adopted an amendment to the International Convention for Safety of Life at Sea (SOLAS) with provisions entitled “Special Measures to Enhance Maritime Safety” which became effective in 1996. Chapter IX of SOLAS requires all tank ships to have safety management system in conformance with International Ship Management Code (ISM Code) for safe operation of ships. Chapter V of SOLAS now requires all tank ships to carry Voyage data recorders to assist in post casualty investigation. These provisions allow for operational testing during port State examinations to ensure that masters and crews for both U.S. and international vessels are familiar with essential shipboard procedures relating to ship safety. The USCG Marine Safety Office conducts these port examinations as part of ~~their~~ its vessel inspection program.

Federal Agencies

A number of Federal laws regulate marine terminals and vessels. These laws address, among other things, design and construction standards, operational standards, and spill prevention and cleanup. Regulations to implement these laws are contained primarily in Titles 33 (Navigation and Navigable Waters), 40 (Protection of Environment), and 46 (Shipping) of the CFR. The most recent act to address spill prevention and response is OPA 90.

OPA 90 was enacted to expand prevention and preparedness activities, improve response capabilities, ensure that shippers and oil companies pay the costs of spills that do occur, and establish an expanded research and development program. The Act also established a one billion dollar Oil Spill Liability Trust Fund, funded by a tax on crude oil received at refineries. A Memorandum of Understanding (MOU) was established to divide areas of responsibility. The USCG is responsible for tank vessels and marine terminals, the EPA for tank farms, and the Research and Special Programs Administration (RSPA) for pipelines. Each of these agencies has developed regulations for their area of responsibility.

All facilities and vessels that have the potential to release oil into navigable waters are required by OPA 90 to have up-to-date oil spill response plans and to have submitted them to the appropriate Federal agency for review and approval. Of particular importance in OPA 90 is the requirement for facilities and vessels to demonstrate that they have sufficient response equipment under contract to respond to and clean up a worst-case spill.

Other key laws addressing oil pollution include:

- Federal Water Pollution Control Act of 1972;
- Clean Water Act of 1977;
- Water Quality Act of 1987;
- Act of 1980 to Prevent Pollution from Ships;
- Resource Conservation and Recovery Act (RCRA) of 1978;
- Hazardous and Solid Waste Act of 1984, and
- Refuse Act of 1899.

Responsibilities for implementing and enforcing the Federal regulations addressing terminals, vessels, and pollution control fall to a number of agencies, as described in the following sections.

United States Coast Guard

The USCG, through Title 33 (Navigation and Navigable Waters) and Title 46 (Shipping) of the CFR, is the Federal agency responsible for vessel inspection, marine terminal operations safety, coordination of Federal responses to marine emergencies, enforcement of marine pollution statutes, marine safety (navigation aids, etc.), and operation of the National Response Center (NRC) for spill response, and is the lead agency for offshore spill response. The USCG implemented a revised vessel boarding program in 1994 designed to identify and eliminate substandard ships from U.S. waters. The program pursues this goal by systematically assessing the relative risk of vessels and increasing the boarding frequency on high risk (potentially substandard) vessels. Each vessel's relative risk is determined through the use of a matrix that factors the vessel's flag, owner, operator, classification society, vessel particulars, and violation history. Vessels are assigned a boarding priority from I to IV, with priority I vessels being the potentially highest risk. The USCG is also responsible for reviewing marine terminal Operations Manuals and issuing Letters of Adequacy upon approval. ~~At the present time, the USCG relies on the CSLC to review Operations Manuals and inspect terminals in the San Francisco Bay.~~ The USCG issued regulations under OPA 90 addressing requirements for response plans for tank vessels, offshore facilities, and onshore facilities that could reasonably expect to spill oil into navigable waterways.

Because studies have shown that the use of double-hull vessels will reduce the probability of releases when tank vessels are involved in accidents, the USCG has issued 33 CFR 157.10(d) ~~regulations~~ addressing double-hull requirements for tank vessels. The regulations establish a timeline for eliminating single-hull vessels from operating in the navigable waters or the Exclusive Economic Zone of the United States after January 1, 2010, and double-bottom or double-sided vessels by January 1, 2015. Only vessels equipped with a double hull, or with an approved double containment system will be allowed to operate after those times. The phase-out timeline is a function of vessel size, age, and whether it is equipped with a single hull, double bottom, or double sides. The phase out began in 1995 with 40-year-old or older vessels equipped with single hulls between 5,000 and 30,000 gross tons, 28 year or older vessels equipped with single hulls over 30,000 gross tons, and 33 year or older vessels equipped with double bottoms or sides over 30,000 gross tons. All new tankers delivered after 1993 must be double hulled. Double-bottom or double-sided vessels can essentially operate 5 years longer than single-hull vessels.

U.S. Environmental Protection Agency

The EPA is responsible for the National Contingency Plan and acts as the lead agency in response to an onshore spill. EPA also serves as co-chair~~man~~ of the Regional Response Team, which is a team of agencies established to provide assistance and guidance to the On-Scene Coordinator (OSC) during the response to a spill. The EPA also regulates disposal of recovered oil and is responsible for developing regulations for Spill Prevention Control and Countermeasure (SPCC) Plans. SPCC Plans are required for non-transportation-related onshore and offshore facilities that have the potential to spill oil into waters of the United States or adjoining shorelines. Shell has a current SPCC Plan.

U.S. Department of Commerce through the National Oceanic and Atmospheric Administration (NOAA)

NOAA provides scientific support for response and contingency planning, including assessments of the hazards that may be involved, predictions of movement and dispersion of oil and hazardous substances through trajectory modeling, and information on the sensitivity of coastal environments to oil and hazardous substances. They also provide expertise on living marine sources and their habitats, including endangered species, marine mammals and National Marine Sanctuary ecosystems, and information on actual and predicted meteorological, hydrological, and oceanographic conditions for marine, coastal, and inland waters, and tide and circulation data for coastal waters.

U.S. Department of the Interior

U.S. Department of the Interior (DOI), through its various offices, provides expertise during spills in a number of areas, as described below:

- U.S. Fish and Wildlife Service (USFWS) – Anadromous and certain other fishes and wildlife, including endangered and threatened species, migratory birds, and certain marine mammals; waters and wetlands; and contaminants affecting habitat resources.
- U.S. Geological Survey (USGS) – Geology, hydrology (groundwater and surface water), and natural hazards.

U.S. Department of Defense (DOD)

U.S. Department of Defense (DOD), through the USACE, is responsible for reviewing all aspects of a project and/or spill response activities that could affect navigation. The USACE has specialized equipment and personnel for maintaining navigation channels, removing navigation obstructions, and accomplishing structural repairs.

State Agencies

California State Lands Commission (CSLC)

~~Chapter 1248 of the Statutes of 1990 (SB 2040), the Lempert-Keene-Seastrand Oil Spill Prevention and Response Act,~~ Pursuant to California Public Resources Code sections 8750 through 8760, the CSLC established a comprehensive ~~approach to~~ program for prevention of ~~and response to~~ oil spills and other incidents in the operations of marine oil terminals. The CSLC Marine Facilities Division (MFD) is responsible for governing marine terminals. Through Title 2, ~~California Code of Regulations (~~CCR) ~~§~~ sections 2300 through 2571, the MFD established a comprehensive program to minimize and prevent spills from occurring at marine terminals, and to minimize spill impact should one occur. These regulations established a comprehensive inspection-monitoring plan whereby CSLC inspectors monitor transfer operations on a continuing basis. All tank ships berthing at marine oil terminals must have a valid Safety Management Certificate and Document of Compliance per ISM Code in conformance with 2 CCR section 2340(c)(31). The safety management system addresses risk management including organizational human elements in the safe operation of ships.

The Marine Oil Terminal Engineering and Maintenance Standards (MOTEMS) were proposed by CSLC, were approved by the California Building Standards Commission on January 19, 2005, and became effective 180 days after approval, on February 6, 2006. The MOTEMS are codified as CCR Title 24, Part 2, California Building Code (CBC), Chapter 31F – ~~(~~Marine Oil Terminals (24 CCR § 3101F et seq.), and the CSLC MFD is the adopting and enforcing agency. Operators/owners of facilities deemed “high risk”, such as the Shell Terminal, must complete the listed tasks within 30 months of the enactment date, i.e., by August 2008, to complete the initial audit process. The standards apply to all existing and new marine oil terminals in California, and include criteria for maintenance, inspection, structural and seismic analysis and design, mooring and berthing, geotechnical considerations, fire, piping, pipeline, mechanical and electrical systems. These regulations:

- Define minimum requirements for Audit, inspection (both above and below water) and evaluation of the structural, electrical, fire, piping/pipeline, and mechanical systems on a prescribed periodic basis, or following a significant damage-causing event;
- Provide criteria for structural loading, deformation and performance-based evaluation considering earthquake, wind, wave, current, seiche and tsunami effects;
- Provide requirements for the safe mooring and berthing of tank vessels and barges;
- Describe requirements for geotechnical hazards and foundation analyses, including consideration of liquefaction potential, slope stability and soil failure;
- Provide requirements for fire prevention, detection and suppression including appropriate water and foam volumes; and
- Provide requirements for piping/pipeline, mechanical and electrical equipment.

CSLC’s marine terminal regulations (Title 2, Division 3, Chapter 1, Article 5 of the ~~California Code of Regulations~~CCR § 2330 Exchange of Information) are similar to, but more comprehensive than, Federal regulations (Title 46 ~~of the Code of Federal Regulations~~CFR, Part 35 Operations, §35.35-30 and Title 33 CFR 156.120, Declaration of Inspection) in the area of establishing exchange of information between the terminal and vessels, information that must be contained in the Declaration of Inspection, requirements for transfer operations, and information that must be contained in the Operations Manual. All marine terminals are required to submit updated Operations Manuals to the CSLC for review and approval.

The CSLC’s regulations ~~also~~ require that ~~prior to the commencement of transfer of persistent oil, a boom shall be deployed to contain any oil that might be released. M~~ all onshore marine terminals, except those “subject to high velocity currents,” deploy boom to enclose the water surface surrounding the vessel (if loading) or the vessel’s entire inboard length at the waterline (if discharging) and either of the following: 1) The entire dock; or 2) Portions of the dock where oil may spill into the water, prior to transfer operations. An “onshore marine terminal subject to high velocity currents” is defined as an onshore terminal at which the maximum current velocities are 1.5 knots or greater for the majority of the days in the calendar year. ~~where it may be difficult or ineffective to pre-deploy a boom, are required to provide sufficient boom, trained personnel, and equipment so that at least 600 feet of boom can be deployed for containment within 30 minutes.~~ The Shell Terminal fits into this category ~~is subject to high velocity currents~~.

This conditional exemption from the pre-booming requirement is based upon the lack of effectiveness of a boom in containing oil at higher current velocities, as well as the considerable difficulty and expense which is encountered in deploying boom under these conditions. When water is moving at speeds higher than 1.5 knots, oil on the surface is entrained under (and, dependent upon wind, sometimes overtops) containment boom. Reducing the effectiveness of oil containment. Deployment of boom in open water and against the current is highly labor-intensive and creates very real personnel hazards. Additionally, there is constant difficulty in providing a stand-off (a gap between the side of the vessel and the boom, so that oil does not merely flow over the boom), which adds to the effort and expense.

Instead, under CCR section 2395(c)(4), onshore marine terminals subject to high velocity currents must provide sufficient boom appropriate to the conditions at the terminal, trained personnel, and equipment maintained in a standby condition at the berth for the duration of the entire transfer operation, so that a length of at least 600 feet of boom can be deployed within 30 minutes of a spill. Shell maintains 2,000 feet of boom on the Shell Terminal that can be deployed within 30 minutes.

A requirement that each marine oil terminal operator must implement a marine oil terminal security program is contained in 2 CCR ~~(Title 2, California Code of Regulations S~~section 2430. At a minimum, each security program must:

- Provide for the safety and security of persons, property, and equipment on the terminal and along the dockside of vessels moored at the terminal;
- Prevent and deter the carrying of any weapon, incendiary, or explosive on or about any person inside the terminal, including within his or her personal articles;
- Prevent and deter the introduction of any weapon, incendiary, or explosive in stores or carried by persons onto the terminal or to the dockside of vessels moored at the terminal; and
- Prevent or deter unauthorized access to the terminal and to the dockside of vessels moored at the terminal.

The Marine Facilities Division has also issued regulations on the following:

- Marine Terminal Personnel Training and Certification; ~~and~~
- Marine Oil Terminal Pipelines; and
- Structural Requirements for Vapor Control Systems at Marine Terminals.

California Department of Fish and Game

The Office of Oil Spill Prevention and Response (OSPR) was created within the California Department of Fish and Game (CDFG) to adopt and implement regulations and guidelines for spill prevention, response planning, and response capability. Final regulations regarding oil spill contingency plans for vessels and marine facilities were issued in November 1993, and last updated in October 2002. These regulations are similar to, but more comprehensive than, the Federal regulations. The regulations require that tank vessels, barges, and marine facilities develop and submit their comprehensive oil spill response plans to OSPR for review and approval.

OSPR's regulations require that marine facilities and vessels be able to demonstrate that they have the necessary response capability on hand or under contract to respond to specified spill sizes, including a worst-case spill. The regulations also require that a risk and hazard analysis be conducted on each facility. This analysis must be conducted in accordance with procedures identified by the American Institute of Chemical Engineers (AIChE).

SB 2040 established financial responsibility requirements and required that Applications for Certificate of Financial Responsibility be submitted to OSPR. California's requirement for financial responsibility is in excess of the Federal requirements.

SB 2040 also requires the OSPR to develop a State Oil Spill Contingency Plan. In addition, each major harbor was directed to develop a Harbor Safety Plan addressing navigational safety, including tug escort for tankers. The Harbor Safety Committee of the San Francisco Bay Region issued its Harbor Safety Plan in 1992, and has issued annual updates since that time. The plan contains several recommendations to improve safety. One recommendation, first implemented in May 1993 through OSPR issuance of the then interim regulations (now permanent), requires that all tank vessels carrying more than 5,000 tons of oil have available a standby tug or be escorted by one or more tugs when transiting through certain zones, as shown in Figure 4.1-1. As can be seen from Figure 4.1-1, tug escorts are required while tankers are transiting from the mouth of the Bay to the terminal.

California Coastal Commission

The California Coastal Commission (CCC) and the San Francisco Bay Conservation and Development Commission (BCDC) have oil spill statutory authority under the following two statutes: California Coastal Act of 1976 and Lempert-Keene-Seastrand Oil Spill Prevention and Response Act of 1990. The CCC responsibilities include all of California's coastal shoreline, including ports and harbors, except for the San Francisco Bay, which falls under the jurisdiction of the BCDC. Responsibilities include:

- Review of coastal development projects related to energy and oil infrastructure for compliance with the Coastal Act and consistency with the Coastal Zone Management Act;

- Attendance at statewide and regional Harbor Safety Committee Area committee and subcommittee meetings, e.g., dispersants, sensitive sites, Area Contingency Plan updates, oiled wildlife operations;
- Review of regulations for oil spill prevention and response, and input on these regulations' consistency with Coastal Act regulations and policies;
- Review of oil spill contingency plans for marine facilities located in the coastal zone/ Bay Area, and oil spill response plans for facilities located on the outer continental shelf;
- Participation in the State Interagency Oil Spill Committee (SIOSC), SIOSC Review Subcommittee, and Oil Spill Technical Advisory Committee meetings and assignments;
- Participation in studies that will improve oil spill prevention, response, and habitat restoration;
- Participation in oil spill drills; and
- Participation in the development of planning materials for oiled wildlife rehabilitation facilities.

4.1.3 Impact Significance Criteria

A public safety impact is considered significant if any of the following apply:

- There is a potential for fires, explosions, releases of flammable or toxic materials, or other accidents from the terminal or from vessels calling at the terminal that could cause injury or death to members of the public;
- The existing facility does not conform to its oil spill contingency plans or other plans that are in effect, or if current or future operations are not consistent with Federal, State, or local regulations. Conformance with regulations does not necessarily mean that there are not significant impacts; or
- Existing and proposed emergency response capabilities are not adequate to effectively mitigate spills and other accident conditions.

The potential for oil or product spills is discussed in this section; however, the potential impact from spills is analyzed in the other resource-related sections, e.g., Section 4.3, Biological Resources, Section 4.2, Water Quality, Section 4.4, Commercial and Sport Fisheries, and Section 4.5, Land Use and Recreation.

Approach to Analyzing Impacts of Upset Conditions

System safety/risk-of-upset impact significance criteria are more difficult to define than those of other environmental issue areas because an accident must occur before an impact can occur. The expected frequency of accidents must be factored into the definition, and to complicate the matter, just because an accident occurs does not mean significant impacts will result. Thus, system safety/risk-of-upset considers both: (1) spills that can potentially impact the environment, and (2) incidents that can potentially impact the safety of the public.

The expected frequency of spills occurring as a function of volume was estimated, as was the extent of area that may be impacted by these spills using available oil spill trajectory modeling results. Note that a spill itself does not necessarily impact the environment unless specific resources are impacted. How a spill impacts the environment is addressed in the other resources sections of this ~~Draft~~ Final EIR, including Section 4.3, Biological Resources, Section 4.4, Commercial and Sport Fisheries, Section 4.5, Land Use and Recreation, and Section 4.9, Visual Resources. Any deficiency in Shell's ability to respond to upset conditions and the potential for impacts to public safety is assessed in this section.

The analysis of the proposed Project quantifies the probability of an accident due to the project from both the tank vessel traffic and the terminal. The analysis considers the specific type, e.g., tankers, barges, and number of vessels that will be calling at the terminal over the lease period, specific design features of the terminal, and the historical accident record. Information regarding potential hazards during vessel approaches and departures is evaluated based on historical data, interviews with people knowledgeable of the area, and information that may be available from the Harbor Safety Committee.

Risk/safety analysis of types of incidents that can occur at the terminal, the consequences of spill incidents, and their expected frequency of occurrence are based on terminal operations. The worst case and most likely spill sizes that could occur from the various components of the terminal have been estimated. The Shell Oil Spill Response Plan approved by the OSPR serves as the basis for this analysis, including a worst-case spill and risk and hazard analysis. Shell's ability to respond and mitigate potential incidents has also been evaluated.

Section 4.11, Geotechnical Resources/Structural Integrity Review, analyzes the terminal design and structural integrity and addresses the structural conditions of the loading platforms, connecting trestle, dolphins and walkways.

4.1.4 Impacts Analysis and Mitigation Measures

4.1.4.1 Spill Response Capability and Potential for Public Risk at the Shell Terminal

Impact OS-1: Shell Terminal Deck Drainage System

~~There are some d~~Deficiencies with the existing deck drainage system and procedures ~~that~~ could pose a risk for, or increase the potential for, spills at the Shell Terminal from routine operations. Preventative maintenance and operational equipment ~~is~~ are required by the MOTEMS. Impacts are adverse, but less than significant (Class III).

In its investigation of the last spill of oil to the water at the Martinez Refinery wharf on January 2, 2006, the Shell Root Cause Analysis (RCA) team examined the layers of protection against oil release at the wharf, and formulated recommendations. In response to the recommendations from the RCA team, Shell corrected gaps identified in the systems, processes and behavior, including modifying the operational guidelines to prevent any future occurrence of a similar incident. All procedural and maintenance-related corrective actions were completed by the end of 2006. ~~The remaining items, related to potential upgrade of the sump pumps and instrumentation, are currently in the engineering, review, and approval process.~~ In June 2008, Shell completed anchorage to the sump pump, repairs to sump components on upstream loading platform (Berth 2), and anchorage to the sump pump on downstream loading platform (Berth 1). In addition, Shell's allision avoidance equipment to monitor vessel impact speed and possible drift off the wharf during transfers is currently operational at the Shell Terminal.

The transfer area of each berth is impounded by a raised berm that drains into a collection system that engages automatically by level control switches. Collection pans are located under all piping manifolds at the berth areas and are designed to collect potential drips from bolted flanges, fittings, and expansion joints. A description of the drip and recovered oil facilities and oil/product transfer procedures is contained in the project description in Section 2.3.2, Physical Description of the Shell Terminal. The emergency shutdown system is described in Section 2.3.3, Operational Procedures, with activation of the emergency shutdown system able to close the pipeline block valves within 60 seconds.

The MOTEMS minimum engineering, inspection and maintenance standards apply to all existing and new marine oil terminals in California, and include criteria for maintenance, inspection, structural and seismic analysis and design, mooring and berthing, geotechnical considerations (including site-specific assessment), and analysis and review of the fire, piping, mechanical and electrical systems. Shell is required to comply with the MOTEMS which became effective on February 6, 2006. Operators/owners of facilities deemed "high risk", such as the Shell Terminal, must complete the initial audit process by August 2008 that includes assessment of the deck drainage and pipe systems and deficiency rehabilitation.

The Shell Terminal completed its MOTEMS Initial Audit in August 2008, and submitted it to the CSLC MFD for review and compliance assessment. The MOTEMS Audit process, including above and below water inspections, will continue throughout the life of the terminal. Refer to Section 2.0 for a description of the MOTEMS Audit and Inspection processes and results of the Initial Audit.

Since the MOTEMS ~~is~~ are a regulatory requirement, impacts from routine operations are considered adverse, but less than significant (Class III).

OS-1. No mitigation is required.

Impact OS-2: Potential Impacts From Gasoline and Other Highly Volatile Product Releases

Potential impacts to public safety from a highly volatile product release are adverse, but less than significant (Class III) since the liquids disperse quickly.

Highly volatile products such as gasoline are highly flammable and evaporate rather quickly. If ignited, the vapors could result in a flammable vapor cloud, which would disperse quickly, and would not present a flammable or toxic gas cloud to the nearby community. Because they are so volatile and easily ignited, Shell states in ~~their~~ its Oil Spill Response Plan that, to avoid ignition, the boom should not be deployed in the vicinity of a highly volatile product spill, even though the highly volatile products are lighter than water and float, the spill and vapors may travel some distance from the pool. The standard response to a highly volatile product spill is to stop the source of the spill, keep vessel and other marine traffic away from the pool to prevent ignition, and wait until the product evaporates ~~until~~ and there is no ignition hazard. This response method is acceptable to the USCG, and no additional response is required. The potential for impacts to other resources are discussed in Section 4.2, Water Quality, and Section 4.3, Biological Resources.

OS-2. No mitigation is required.

Impact OS-3: Potential for Spills and Response Capability for Containment of Class I-IV Oil Spills From Shell Terminal During Transfer Operations.

Shell's response capability for containment of spills during transfer operations would still result in adverse and significant impacts for spills greater than 50 bbls. Consequences would range from spills that can be contained during first response efforts with rapid cleanup (Class II), to those complex spills that result in a significant impact (Class I) with residual effects after mitigation.

Potential for Spills from the Terminal

Spills may originate from the Shell Terminal or from the vessel and may be due to natural factors (earthquake, tsunami, severe environmental conditions, etc.), human error (berth collision, bad hose connection, ineffective mooring line tending, etc.), or deterioration. Potential sources of a spill from the Shell Terminal include drip pans, hydraulic hoses, loading hoses and fittings, pipelines and fittings, and valves. As discussed in Section 4.11, Geotechnical Resources/Structural Integrity Review, the potential for Shell Terminal structural damage ~~is currently unknown~~ has been assessed in accordance with the MOTEMS (Halcrow 2008) and therefore, the impacts from a major earthquake ~~may~~ are being addressed to prevent damage to the structure which ~~can result~~ could have potentially have resulted in pipeline damage and subsequent spills. ~~The MOTEMS requirements, which became effective on February 6, 2006, require Shell to complete the initial audit process the August 2008 for the terminal.~~ As noted above, Shell completed its MOTEMS Initial Audit in August 2008 for the Shell Terminal, and submitted it to the CSLC

MFD for review and compliance assessment. The MOTEMS Audit process will continue throughout the life of the terminal. Refer to Section 2.0 for a description of the MOTEMS Audit and Inspection processes and results of the Initial Audit.

A release from a vessel while at the Shell Terminal is also possible. As a worst case, the entire contents of a vessel could be released; however, this is not considered a realistic scenario. The CSLC spill database (see Section 4.1, Environmental Setting) differentiates between spills from the Shell Terminal and spills from the vessel at the Shell Terminal. The largest release from a tank vessel (all tank vessels, not just those calling at the Shell Terminal) in the Bay between 1992 and 2001 was 420 gallons of ~~jet~~ fuel oil (10 bbls). The largest release from a tank vessel between 2001 and 2008 was 58,082 gallons of fuel oil (1,383 bbls) in 2007.

Spill Planning Volumes

EPA, USCG, and CSLC have specified methods for calculating three levels of spill planning volumes for use in determining the minimum amount of spill response equipment/capability that must be available within specified times frames to respond to the release. These are discussed below.

- Reasonable Worst-Case Discharge (WCD). The WCD volume is discussed in Section 4.1.1, Environmental Setting, and equates to 9,180 bbls of oil.
- Maximum Most Probable (Medium) Discharge. The USCG defines this discharge as the lesser of 1,200 bbls or 10 percent of the volume of the WCD. The WCD is 9,180 bbls and thus, the maximum most probable discharge is 918 bbls.
- Average Most Probable (Small) Discharge. EPA defines the average most probable discharge as 50 bbls, not to exceed the WCD while the USCG defines it to be the lesser of 50 bbls or 1 percent of the WCD (92 bbls in this case). Thus, the average most probable (small) discharge planning volume is 50 bbls.

Probability of Release

Probability of Spills from the Shell Terminal

The CSLC spill data, augmented by additional data for larger spills, were used to estimate the probability of spills from the Shell Terminal. The average number of vessel calls in the Bay ~~over the past 14 years has been~~ between 1992 and 2005 was approximately 2,800 per year resulting in a probability of a spill per vessel call of 4.1 X 10^{-3}. The largest spill ~~during the 14-year period~~ between 1992 and 2008 was ~~26~~ 1,383 bbls (~~1,092~~ 58,082 gallons). While the probability of a spill is presented in terms of spills per vessel transfer, the database includes spills that occur even when a vessel is not present. However, the vast majority of spills occur when vessels are present and it is generally believed that including other spills in the calculations does not bias the results. Therefore, the cited probability reflects the probability of spills at the Shell Terminal from all causes and not just those associated with transfer operations.

To estimate the probability of a spill greater than 26 bbls, worldwide data were used. Based on the review of the various components of the Shell Terminal discussed above, it is believed that spill statistics for marine terminals worldwide can be used to estimate the potential for a large spill from the Shell Terminal.

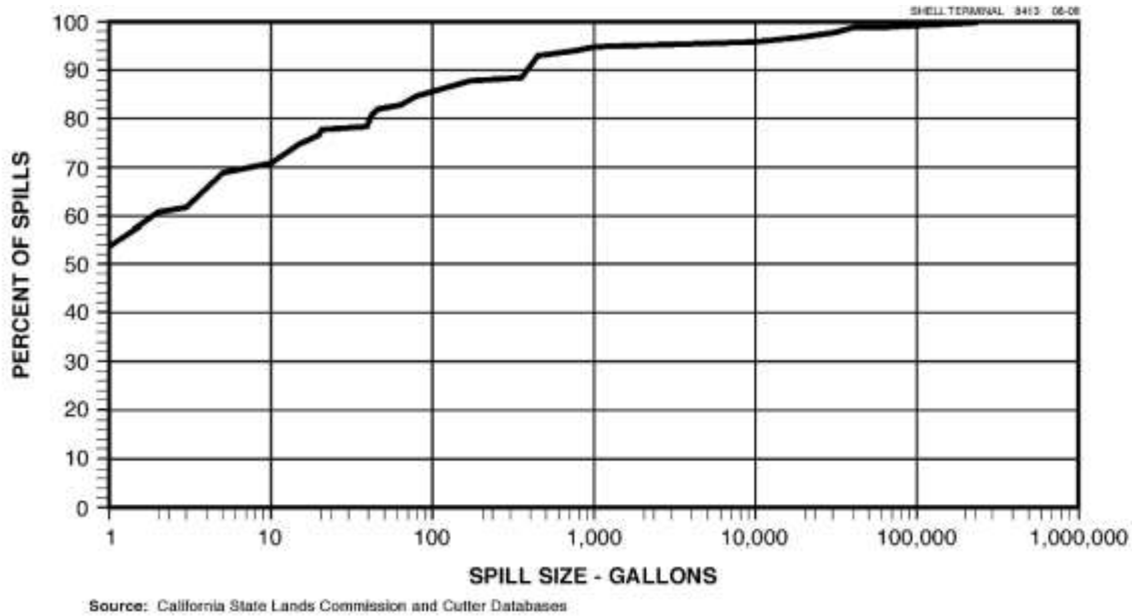
Aspen Environmental Group (1992) estimated that the “at-pier” spill rate for spills greater than 1,000 bbls (about 42,000 gallons) is 0.95 spills per 10,000 port calls for tankers worldwide. Because of the safety record of the San Francisco Bay Area, Aspen applied a 0.4 historical modifier to the worldwide spill rate, resulting in a spill rate estimate of 0.38 spills greater than 1,000 bbls per 10,000 port calls (3.8×10^{-5} spills per port call). The spill rate for tankers involved in Alaskan crude trade is 0.44 spills greater than 1,000 bbls per 10,000 port calls, similar to the modified Bay Area estimate.

To estimate the probability of smaller size spills of 238 bbls (10,000 gallons), information on spills occurring between 1978 and 1988 published by Cutter Information Corporation (1989) was analyzed. Based on this database, the probability of spills greater than 238 bbls at marine terminals in the Bay Area is estimated to be 2.7×10^{-4} per port call. The database also shows that the spill rates are essentially the same for tankers and tank barges. The spill rates for spills greater than 238 bbls and 10,000 gallons discussed here were also used in the Unocal San Francisco Refinery Marine Terminal EIR (Chambers Group 1994).

The CSLC and Cutter databases were used to develop a spill size distribution for the Shell Terminal. Figure 4.1-4 presents the curve for the combined distribution. Because the majority of spills are small, a logarithmic scale was used for the spill size axis. As can be seen in the figure, 54 percent of the spills are less than 1 gallon, 70 percent less than 10 gallons, 86 percent less than 100 gallons, and 95 percent less than 1,000 gallons. The projected annual maximum number of vessels (tankers plus tank barges) that could call at the Shell Terminal over the lease period, is 330, thus the following estimated spill frequencies are based on 330 vessel calls per year.

Based on these data, an average of about 1.5 spills per year can be expected from the Shell Terminal. About half would be less than 1 gallon. The probability of a spill larger than 23.8 bbls (1,000 gallons) from the Shell Terminal is 4 percent or 1 spill every 25 years. During the ~~past 12 years~~ period from 1992 to 2005 there has been 1 spill greater than 23.8 bbls (1,000 gallons) from a marine terminal in the Bay Area. The annual probability of a spill greater than 1,000 bbls (42,000 gallons) from the Shell Terminal is 1.2 percent. This equates to an expected mean time between spills of 80 years. Over a 30-year lease, there would be a 30 percent probability that a spill (one or more) greater than 1,000 bbls (42,000 gallons) would occur. The probability of a spill greater than 1,000 bbls (42,000 gallons) in 30 years is determined by calculating the probability of no spills in 30 years which is equal to the probability of no spills in a single year ($1-0.012 = 0.988$) raised to the thirtieth power ($0.988^{30} = 0.696$) and then subtracting this from 1 ($1 – 0.696 = 0.30$). The probability of a spill (one or more) in a given time period is equal to one minus the probability of no spills in that time period.

Figure 4.1-4. Cumulative Spill Size Distribution



Chambers Group

CUMULATIVE SPILL SIZE DISTRIBUTION
Figure 4.1-4

The consequences of a spill would depend on the size of the spill, the effectiveness of the response effort, and the biological, commercial fishery, shoreline, and other resources affected by the spill. A spill of 1 gallon or less would result in an adverse impact that can be mitigated, while a large spill of 1,000 bbls (42,000 gallons) most likely would result in a significant, adverse impact that would have residual effects after mitigation. The impacts of spills between 1 gallon and 1,000 bbls (42,000 gallons) depend on the effectiveness of response efforts and the resources impacted. An analysis of Shell's oil spill response capabilities is presented below. The impacts of a release on other resources are addressed in the other subsections of Section 4.1, Operational Safety/Risk of Accidents.

Response Capability

Shell's response assets are described in Section 4.1.1, Environmental Setting. The following describes the steps Shell would most likely follow in the event of a spill and the potential effectiveness of the response. The responses described below are for releases of Group III or IV crude oils and persistent products. Response to releases of flammable products, that is those with flash points below 100º Fahrenheit (F) such as gasoline, would consist primarily of ignition control and is described in Impact OS-2 above. Reponses to Group V oils would be different because these materials are heavier than water and do not stay on the surface. Group V oil spill response is presented in Impact OS-4 below.

CSLC regulations require that all onshore marine terminals, except those "subject to high velocity currents," deploy boom to enclose the water surface surrounding the vessel (if loading) or the vessel's entire inboard length at the waterline (if discharging) and either of the following: 1) the entire dock; or 2) portions of the dock where oil may spill into the water, prior to transfer operations. An "onshore marine terminal subject to high velocity currents" is defined as an onshore terminal at which the maximum current velocities are 1.5 knots or greater for the majority of the days in the calendar year. The Shell Terminal fits into this category.

This conditional exemption from the pre-booming requirement is based upon the lack of effectiveness of a boom in containing oil at higher current velocities, and the considerable difficulty that is encountered in deploying boom under such conditions. When water moves at speeds greater than 1.5 knots, oil on the surface is entrained under (and, dependent upon wind, sometimes overtops) containment boom, thus reducing the effectiveness of oil containment. Deployment of boom in open water and against the current is highly labor-intensive and creates personnel hazards. Additionally, there is constant difficulty in providing a stand-off (a gap between the side of the vessel and the boom, so that oil does not merely flow over the boom.

Shell's first step upon discovering a release of a Group III or IV oil would be to attempt to stop it, e.g., activate emergency shutdown system. Shell would then activate ~~their~~ its spill response team. This would include the personnel on duty at the Shell Terminal and spill response personnel at the Refinery. The next step would most likely be to deploy the boom on the Shell Terminal. Shell maintains two spill response boats which are capable of deploying boom at the Shell Terminal. The boom would be deployed on the down-current side of the spill in an attempt to prevent the oil from drifting away to where it could impact sensitive environmental resources and commerce. Additional fast response vessels, boom carrying/deploying vessels, boom, personnel, and other response equipment are available from MSRC. The current itself would assist in deploying the boom in the shape of a catenary curve. Oil would be recovered with sorbent material and/or skimmers.

As stated above, Shell maintains sorbent material at the Shell Terminal. Numerous skimming vessels and additional sorbent material are available from MSRC. Five response boats are berthed in Martinez including the *Spill Spoiler* and *Sentinel*, both of which are equipped with skimmers, boom, and 90 bbls of storage. MSRC can also supply oil storage devices to collect the recovered oil. Even though Shell is compliant with USCG regulations for spill response for responding to a small (50 bbls) spill, there are additional protective measures available that can be applied to maximize protection against accidental spills and damage to either the wharf or vessel, thus without these additional measures, impacts are significant for small spills (Class II). However, the impacts associated with the consequences of larger spills, greater than 50 bbls, could remain significant (Class I). The use of dispersants would need to be authorized in consultation with the Environmental Unit within the Planning Section of a Unified Command; due to a number of concerns, it is not likely that dispersant use would be authorized within the Bay/Delta estuary; although offshore use may be considered.

Preventative Maintenance

The MOTEMS ~~has~~ have set minimum requirements for preventative maintenance that include~~s~~ periodic inspection of all components related to transfer operations. Shell is required to comply with those requirements.

Mitigation Measures for OS-3: The following shall be completed by Shell within ~~12~~ 24 months of lease implementation, unless otherwise specified.

OS-3a. **Remote Release Systems:** ~~Provide~~ Install and maintain mooring quick release devices that shall be able to be activated within 60 seconds.

- These devices shall be capable of being engaged by~~, in addition to the manual release mechanism, an~~ electric/push button release mechanism ~~as well as~~ and by ~~a~~ integrated remotely-operated release ~~mechanism~~ system.
- Shell shall document procedures and training for systems use and communications between Terminal and vessel operator(s).
- Routine inspection, testing and maintenance of all equipment and systems in accordance with manufacturers' recommendations and necessity are required to ensure safety and reliability, to the satisfaction of California State Lands Commission (CSLC) staff.
- Shell may install alternate technology that provides an equivalent level of protection, as reviewed by CSLC staff and approved by the Commission at a publicly noticed meeting.

These measures would allow a vessel to leave the Shell Terminal as quickly as possible in the event of an emergency (fire, explosion, accident, or tsunami) that could lead to a spill~~)~~ that could impact the Shell Terminal or the vessel.

OS-3b. **Tension Monitoring Systems (TMSs).** Install ~~devices~~ and maintain TMSs to effectively ~~continuously~~ monitor all mooring line and environmental loads, and avoid excessive tension or slack line conditions that could result in damage to the terminal structure and/or equipment and/or vessel mooring line failures that could result in spills.~~moored vessels' movements. The devices shall monitor for serge sway, and heave in real time, in the control room during all transfer operations. An alarm system (visual and sound) that incorporates communication to the control-building operator shall also be a part of the system.~~

- Line tensions and environmental data shall be integrated into systems that record and relay all critical data to the Control Room, terminal operator(s) and vessel operator(s).
- This system shall include, but not be limited to, quick release hooks only (with load cells), site-specific current meter(s), site-specific

anemometer(s), and visual and audible alarms that can support effective preset limits and shall be able to record and store monitoring data.

- Shell shall document procedures and training for systems use and communications between Terminal and vessel operator(s).
- Routine inspection, testing and maintenance of all equipment and systems in accordance with manufacturers' recommendations and necessity are required to ensure safety and reliability, to the satisfaction of California State Lands Commission (CSLC) staff.
- Shell may install alternate technology that provides an equivalent level of protection, as reviewed by CSLC staff and approved by the Commission at a publicly noticed meeting.

OS-3c. **Allision Avoidance Systems:** Install and maintain Allision Avoidance Systems (AASs) at the Shell Terminal to prevent damage to the ~~pier~~ wharf and/or vessel during docking and berthing operations.

- The AASs shall be used and alarmed to monitor vessel drift (both surge and sway) during all mooring operations, and shall be equipped with an AIS receiver to capture passing vessel parameters.
- This shall be integrated with the Tension Monitoring Systems such that all data collected are available in the Control Room and to Terminal operator(s) at all times and vessel operator(s) during berthing operations. The AASs shall also be able to record and store monitoring data.
- Prior to implementing this measure, Shell shall consult with the San Francisco Bay Bar Pilots (SFBBP), the U.S. Coast Guard, and the California State Lands Commission (CSLC) staff and provide information that would allow CSLC staff to determine, on the basis of such consultations and information regarding the nature, extent and adequacy of the existing berthing system, the most appropriate application and timing of an AASs at the Shell Terminal.
- Shell shall document procedures and training for systems use and communications between Terminal and vessel operator(s).
- Routine inspection, testing and maintenance of all equipment and systems in accordance with manufacturers' recommendations and necessity are required to ensure safety and reliability, to the satisfaction of CSLC staff.

Rationale for Mitigation:

MM OS-3a: The Shell Terminal ~~is located in a high velocity area in the Carquinez Strait and~~ currently has no mechanisms that would allow the quick release of mooring lines in the event of an emergency. In the event of a fire, ~~oil spill, earthquake, or~~ tsunami, explosion or other emergency, quick release of the mooring lines within 60 seconds would allow the vessel to quickly leave the Shell Terminal which could help prevent damage to the Shell Terminal and vessel and avoid and/or minimize spills. These measures may also help isolate an emergency situation, such as a fire or explosion, from spreading between the terminal and vessel, reducing oil spill potential. By providing mooring release devices capable of being engaged by~~, in addition to the manual release mechanism, an~~ a locally initiated electric/push button release ~~mechanism~~ system and by a remotely-operated release mechanism, Shell shall have several different options to cover emergency situations.

MM OS-3b: The Shell Terminal is located in a high velocity current area in the Carquinez Strait and currently has no mechanisms to monitor mooring line tending and integrated environmental conditions. Monitoring moored vessels ~~movements~~ line strains and environmental conditions enables ~~loading~~ informed and controlled transfer operations to continue in ~~marginal~~ harsh weather conditions, high velocity current conditions and/or other conditions where ~~the limits of strain on~~ excessive tension or slack in the mooring lines could result in failure of mooring lines and/or significant movement of the vessel resulting in damage to the Shell Terminal and/or vessel. (Tension Monitoring Systems are unable to directly monitor vessel movements; this is addressed in MM OS-3c.)

Devices able to continuously monitor moored vessels' ~~movements will~~ line strains and alarm at preset limits can warn operators of the development of dangerous mooring situations, allowing time to take corrective action and minimize the potential for ~~excessive surge or sway of the vessel (motion parallel or perpendicular to the wharf), which could lead to an oil spill,~~ the parting of mooring lines, which can quickly escalate to the breaking of hose connections, the breakaway of a vessel, and/or other unsafe mooring conditions, that could ultimately lead to an oil spill ~~or breaking of loading arms~~. Real time ~~operations~~ data monitoring and control room information provides the Terminal Person-In-Charge (TPIC) with immediate knowledge of whether ~~design~~ safe operating limits of the moorings are being exceeded. Backed up by an alarm system, mooring adjustments can be made to prevent damage and accidental conditions.

MM OS-3c: Located in a high velocity current area, the Shell Terminal is subject to "unfavorable" site conditions in accordance with the MOTEMS Section 3103F.6.7. At present, the docking system relies on the pilot's judgment to determine the vessel's approach speed and angle. ~~An~~ Allision Avoidance Systems (AASs) would monitor an approaching vessel's speed, approach angle ~~el~~, and distance from the dock to keep the potential impact velocity within the maximum elastic allowable limits of the fender/structural system, and thus help to prevent damage to the Shell Terminal and/or vessel due to vessel impact, that could lead to an oil spill. Monitoring these factors will ~~indicate that an impact velocity over the maximum allowable limits could occur~~ ensure that all vessels can safely berth at the terminal and comply with the minimum standards required in the MOTEMS. Furthermore, monitoring moored vessels' movements and passing vessels ensures that all vessels can remain securely moored against the terminal and comply with the minimum standards required in the MOTEMS. Excessive surge or sway of vessels (motion parallel or perpendicular to the wharf, respectively) and/or passing vessel forces may result in sudden shifts/redistribution of mooring forces through the mooring lines, which can quickly escalate to the failure of mooring lines, breaking of hose connections, the breakaway of a vessel, and/or other unsafe mooring conditions, that could ultimately lead to an oil spill.

For all OS-3 equipment and systems, procedures and training for systems use and communications between Terminal and vessel operator(s) must be documented. Routine inspection, testing and maintenance of all equipment and systems in accordance with manufacturers' recommendations and necessity are also required to ensure safety and reliability. Advancing s~~S~~afety technology would provide flexibility in the lease to continually update mitigation requirements and improve safety at the Shell Terminal.

Residual Impacts: Impacts associated with the consequences of larger spills, greater than 50 bbls, could remain significant (Class I).

Impact OS-4: Group V Oils

Group V oils have a specific gravity greater than 1 and do not float on the water; instead, they will sink below the surface into the water column or possibly to the bottom. Shell does not identify the types of oils by Group that ~~they~~ it handles in ~~their~~ its Oil Spill Response Manual nor ~~do they~~ does Shell discuss response capabilities by Group. Shell handles asphalt and other products that may be Group V oils. If this is the case, a release of a Group V oil could result in significant impacts (Class I).

OSPR regulations stipulate that all facilities that transfer Group V oil must identify equipment that can be used to monitor, detect and/or recover it. Shell does not address Group V oils or identify equipment that can be used to respond to Group V spills. If Shell does not handle Group V oils, this must be stated in ~~their~~ its Oil Spill Response Manual. ~~There are l~~ Local dredging companies are not authorized or trained spill response handlers and should not be relied upon to provide these services ~~that may be able to assist in the event of a Group V spill. These companies can provide dredges, pumps, detection devices (fathometers with frequencies high enough to identify submerged oil), and silt curtains (silt curtains must be ordered from out of the area)~~. It is difficult to monitor and predict the movement of Group V oils and to recover the oil while it is in the water. Consistent with the findings found in Section 4.3, Water Quality, a Group V oil spill would be a significant, adverse (Class I) impact.

Mitigation Measures for OS-4:

OS-4. Shell shall ~~not handle~~ consult with the California State Lands Commission (CSLC) and Office of Spill Prevention and Response (OSPR) staffs regarding Group V oil spill response technology including potential new response equipment and techniques that may be applicable for use at the Shell Terminal. Shell shall work with the CSLC and OSPR in applying these new technologies, as agreed upon, if recommended for this facility. ~~oils (oils~~

~~have a specific gravity greater than 1 and do not float on the water) until it has installed the required Group V oil spill mitigating equipment and incorporated the specific response procedures into its Oil Spill Pollution Prevention and Response Plan. If Shell intends to handle Group V oils, they shall notify the CSLC in writing with submission of the engineering designs of the proposed equipment for MFD review. The restriction shall remain in place until Shell decides to handle Group V oils and has completed the process of implementing the required changes.~~

Rationale for Mitigation: This measure would require Shell to ~~meet~~ address OSPR requirements regarding response to Group V spills and to provide flexibility in the lease to continually update mitigation requirements and improve response capabilities for response to Group V oils by requiring Shell to implement the latest practical response technologies.

Residual Impacts: This measure may reduce the potential impacts from releases of Group V oils; however, the residual impact could remain significant (Class I).

Impact OS-5: Shell Terminal Spills from Pipelines during Non-Transfer Periods.

Spills from the Shell Terminal during non-transfer periods would most likely be associated with pipelines. Shell is required to comply with the MOTEMS, and impacts are considered adverse, but less than significant (Class III).

Shell has an extensive pipeline inspection program in place (refer to Section 2.3.3, Operational Procedures). Should leakage from a pipeline, or oil containment or recovery system occur during routine piping and loading/unloading operations, impacts would be considered significant. However, the MOTEMS have~~s~~ set requirements for preventative maintenance that include~~s~~ periodic inspection of all terminal components. Shell is required to comply with those requirements. Information on the structural integrity of the Shell Terminal is addressed in Section 4.11, Geological Resources/Structural Integrity Review.

Mitigation Measures for OS-5:

OS-5. No mitigation is required.

Impact OS-6: Potential for Fires and Explosions and Response Capability

Residential areas are beyond the hazard footprint boundary; however, there is an extremely small probability that the Martinez Marina could be impacted by a tanker explosion. Because of the extremely low probability of this event, it is concluded that fires and explosions would not cause a public safety risk (Class III). However, a major fire at the Shell Terminal could result in a significant oil spill. Hence, a significant impact has been identified (Class II).

Risk Potential and Safety Features

Although there have been no reported fires or explosions at the Shell Terminal during the past 10 years, fires and explosions are possible at the Shell Terminal involving vessels and/or the Shell Terminal itself. Shell has instituted several measures to minimize the potential for fires and explosions.

First, vessels loading or unloading low-flash cargoes (cargoes having a flash point of less than 150ºF) are required to have properly operating inert gas systems (IGS). An IGS generates an inert gas that is injected into the cargo tanks to displace the oxygen to a level that will not support ignition. The Vessel Person-In-Charge (VPIC) is required to verify that the tanks are inerted and that the IGS is working properly before transfer operations can commence. Products with flash points greater than 150ºF do not generate enough vapors to support ignition unless the product is heated to a temperature above 150ºF. The Shell Terminal does not transfer any products that would produce gas cloud hazard footprints that would cause health and safety risks to the public.

A second potential area for a fire or explosion is the Vapor Control System (VCS). The VCS is described in Section 2.3.2, Physical Description of the Shell Marine Terminal. The VCS is designed to provide fire and explosion protection. To prevent fires and explosions in the system, natural gas is injected into the vapor stream to enrich the recovered vapors (vapors coming off the vessel during loading operations). A hydrocarbon analyzer measures and verifies that the proper enrichment values are met. Nitrogen is used to purge the vapor hose at the end of all vapor transfer operations. An insulating unit electrically isolates the vapor hose from the Shell Terminal. Static charges developed in the hose during vapor transfer will flow back to the vessel. An insulating flange is provided at the berth end of the hose to electrically isolate the hose and the vessel from the berth.

A detonation arrester is installed in the vapor pipeline of each berth to prevent a flame from passing from the Shell Terminal to the ship. Shell submitted information on the VCS as originally designed and installed to the USCG in compliance with the requirements of 33 CFR 154. Shell has also performed a Safeguarding Analysis (Shell, undated) of the VCS. A ~~l~~Letter of ~~a~~Adequacy for the VCS has been issued by the USCG (1991). A copy of this letter is contained in Shell's Wharf Operations Manual. The USCG reviews the VCS test records as part of ~~their~~ its annual facility inspection. Hence, a less than significant impact would be expected from the VCS.

Aspen Environmental Group (1992), based on the U.S. Minerals Management Service (now Bureau of Ocean Energy Management, Regulation and Enforcement) Tanker Spill Database, showed that 21.6 percent of spills greater than 1,000 bbls at a pier were due to fires or explosions. Chambers Group (1994) estimated that the probability of a fire or explosion per vessel call at the Unocal (now ConocoPhillips) Rodeo Marine Terminal is 1 X 10^{-6}. Based on the safety features at the Shell Terminal and the required use of IGSs, the Chambers Group estimate appears to be overly conservative and therefore the estimate has been decreased by a factor of ten. This estimate then results in an expected meantime between fires or explosions at the Shell Terminal of 30,000 years.

Hazard Footprint Area Generated by Radiant Heat or Explosion

A fire could result in the generation of radiant heat and an explosion could create flying debris and blast overpressure, both of which could have an impact on members of the public. The Ports of Los Angeles (POLA) and Long Beach (POLB) have Risk Management Plans (POLB 1981; POLA 1983) as addenda to their Port Master Plans, which specify the methodology to be used for calculating “hazard footprints” from marine terminals and tank vessels. These Risk Management Plans do not require hazard footprints to be calculated for vessels equipped with IGSs because the risk of fire and explosion is so small. Nevertheless, this methodology has been used here to calculate the “hazard footprint” or area at risk from fires and explosions. The radiant heat footprint capable of causing second-degree burns to exposed skin after 30 seconds of exposure (1,600 British thermal units [Btu] per square foot per hour) was calculated to be 300 feet around the ships. An explosion involving one of the tanks could send flying debris up to 1,500 feet from the ship.

The radiant heat hazard footprint would not pose a significant hazard to the public because there are no public areas within 300 feet of the Shell Terminal area (Class III). The nearest shoreline is approximately 800 feet from the nearest Shell Terminal wharf, while the nearest residence is approximately 0.74 mile (3,900 feet) from the nearest Shell Terminal wharf. The Martinez Marina is approximately 1,000 feet from the nearest Shell Terminal wharf and could potentially be impacted by flying debris from a vessel explosion. However, this impact is classified as less than significant because of the “rare” probability of occurrence. It is also noted that the flying debris hazard footprint should not present a hazard to any of Shell’s storage tanks, the nearest of which is over 0.38 mile (2,000 feet) from the wharves (Class III).

Fire Response Capability

Drawing No. 2T-13164-1 (Appendix I, page 122) ~~Figure 7.1~~ of Shell’s Wharf Operations Manual (2010) lists fire protection equipment available at the Shell Terminal and Shell Terminal approach. ~~The manual provides information that is not consistent with the MOTEMS requirements effective since February 6, 2006. For example, the Manual provides only minimal procedures for dealing with tank vessel fires, emergency response, and for conducting periodic fire drills. This may be a deficiency in the manual and in planning for emergency response. Since MOTEMs became effective, February 6, 2006,~~ However, the Operations Manual is not intended to provide comprehensive fire response documentation. Shell is required to ~~be consistent~~ comply with the requirements of the MOTEMS sections 3102F3.8 and 3108F2.2, for a MOT Fire Plan and its contents~~, of 24 CCR, Part 2 California Building Code, Chapter 31F~~. ~~This is~~ Shell has submitted its Fire Plan for a MOTEMS compliance assessment. No discussion or procedure for dealing with tank vessel fires could be found in Shell’s Operations Manual or MOTEMS Audit. This has been identified as a deficiency in planning for emergency response and is considered a significant impact (Class II).

Shell also maintains its own fire/emergency response department with full-time trained personnel at the Refinery. These personnel are trained in fighting petroleum fires and fires at the Shell Terminal. The first line of defense for a fire onboard a tanker or tank barge is the onboard fire protection systems. Tankers are required by federal regulation (46 CFR 34) to have sophisticated firefighting systems which include fire pumps, piping, hydrants, and foam systems. Tank barges are required only to have portable fire extinguishers, while some are equipped with built-in systems. The tank vessel crews are trained in the use of the firefighting equipment. The onboard firefighting equipment is sufficient to extinguish most fires.

The USCG has prepared and issued a Marine Fire Fighting Contingency Plan (USCG 2000). The plan addresses risk assessment including damage potential, strategic planning, management of response efforts, and response resources available. This addresses what the USCG provides to manage and coordinate resources in the event of a tanker fire.

Minimal discussion of procedures for dealing with tank vessel fires could be found in Shell's manuals addressing fires, emergency response, or for conducting periodic fire drills. This has been identified as a deficiency in the manual and in planning for emergency response, therefore, the potential for a significant, adverse (Class II) impact results.

Mitigation Measures for OS-6:

OS-6a. Shell shall implement MM ~~(Mitigation Measure)~~ OS-3a to provide ~~for quick release devices, capable of being activated within 60 seconds~~ and maintain effective Remote Release Systems, which would allow a vessel to depart the Shell Terminal quickly in the event of a fire and/or explosion that could lead to a spill. These measures would also allow for the ability to isolate the terminal and/or vessel from an emergency situation that could lead to a spill.

OS-6b. Shell shall develop a Fire Plan~~, including a set of procedures, training and drills~~ consistent with Section 3108F2.2 of 24 CCR, Part 2, California Building Code, Chapter 31F. Shell shall also develop a set of procedures and conduct training and drills for dealing with tank vessel fires and explosions for tankers berthed at the terminal. The procedures shall include the steps to follow in the event of a tank vessel fire and describe how Shell and the vessel will coordinate activities. The procedures shall also identify other capabilities that can be procured if necessary in the event of a major incident. ~~Shell shall submit t~~ The Fire Plan and procedures shall be submitted to the California State Lands Commission (CSLC) within 90 days of lease renewal ~~signing the lease agreement, or~~

~~by August 6, 2008, whichever comes first~~. The CSLC shall have final approval of the plan.

Rationale for Mitigation:

MM OS-3a: The Shell Terminal ~~is located in a high velocity area in the Carquinez Strait and~~ currently has no mechanisms that would allow the quick release of mooring lines in the event of an emergency. In the event of a fire, explosion, ~~oil spill, earthquake, or~~ tsunami or other emergency, quick release of the mooring lines within 60 seconds would allow the vessel to quickly leave the Shell Terminal which could help prevent damage to the Shell Terminal and vessel and avoid and/or minimize spills. These measures may also help isolate an emergency situation, such as a fire or explosion, from spreading between the terminal and vessel, reducing oil spill potential. By providing mooring release devices capable of being engaged by~~, in addition to the manual release mechanism, an~~ locally initiated electric/push button release mechanisms and by ~~a~~ integrated remotely-operated release ~~mechanism~~ systems. Shell shall have several different options to cover emergency situations.

~~For Impact~~ **MM OS-6b**:~~,~~ Shell's Operations Manual and MOTEMS Audit presently ~~has~~ have limited discussion of procedures for dealing with tank vessel fires or emergency response. Adequate procedures shall be developed ~~and incorporated into Shell's Operations Manual~~. These should include the steps to follow in the event of a tank vessel fire and describe how Shell and the vessel will coordinate activities. The procedures shall also identify other capabilities that can be procured if necessary in the event of a major incident. Procedures, training, and drills need to be in place in planning for emergency response, so that the Shell Terminal operations crew has the appropriate steps to follow to ensure that emergency response measures are implemented without incident in an emergency situation. ~~The time requirement of Fire Plan submittal to the CSLC within 90 days of signing the lease agreement, or by August 6, 2008, whichever comes first, gives the CSLC flexibility depending on when the lease is actually implemented.~~ These measures will help to reduce the probability of a fire or increase response capability. Implementation of these measures can reduce impacts to less than significant.

4.1.4.2 Accidents and Safety Risk Within the Bay and Outer Coast

Impact OS-7: Response Capability for Accidents in Bay and Outer Coast.

Spills from accidents in the Bay could result in impacts to water quality or biological resources that could be significant adverse (Class II) impacts for ~~those~~ spills that can be if contained during first response efforts; or significant adverse (Class I) impacts that would have residual impacts. While Shell does not have legal responsibility for tankers it does not own, it does have responsibility to participate in improving general response capabilities.

Probability of Bay Vessel Traffic Accidents

The probability estimates for tanker and barge spills from vessel traffic accidents are based primarily on data contained in the Unocal San Francisco Refinery Marine Terminal EIR (Chambers Group 1994), Gaviota Terminal Company (GTC) EIR (Aspen Environmental Group 1992), and the Port Needs Study (USCG 1991b). Table 4.1-8 presents the spill probabilities from three causes; (1) collisions which are impacts between two or more moving vessels, (2) rammings (or allisions) which are moving vessels running into stationary objects, and (3) groundings for both tankers and barges. These probabilities were calculated from the individual probabilities of small, medium, and large vessels, considering the volume of traffic in each category (derived from data in USCG 1991). In accordance with the methodology in Aspen, a 0.1 reduction factor has been applied to tanker and barge groundings for double-bottom and double-hull vessels and a 0.71 reduction factor has been applied to tanker and barge collisions for double-hull vessels. The estimated probabilities of spills from the various types of tankers and barges, after applying the reduction factors, are presented in Table 4.1-9.

Table 4.1-8. Spill Probabilities by Cause for Tankers and Barges

Vessel Type	**Probability of Spill > 100 Gallons per Vessel**			
	Collision	**Ramming**	**Grounding**	**Total**
Tanker	9.12×10^{-7}	1.42×10^{-7}	5.58×10^{-7}	1.61×10^{-6}
Barge	4.86×10^{-6}	1.50×10^{-6}	6.02×10^{-7}	6.96×10^{-6}
Source: Derived from data contained in USCG 1991.				

Table 4.1-9. Spill Probabilities per Vessel Type

Vessel Type	**Probability of Spill > 100 Gallons per Vessel**		
	Single Hull	**Double Bottom**	**Double Hull**
Tanker	1.6×10^{-6}	1.1×10^{-6}	8.4×10^{-7}
Barge	7.0×10^{-6}	N/A	5.0×10^{-6}
Source: Derived from data contained in USCG 1991.			

Most tank vessels calling at the Shell Terminal are double-hull and the vast majority of the tankers are double-hull. For analysis purposes it has been presumed that 95 percent of the tankers are double-hull and that 20 percent of the barges are double-hull. As stated earlier, it has been estimated that the Shell Terminal may handle up to 330 vessel calls per year. Based on historical data, it has been presumed that 40 percent the vessel calls are tankers and 60 percent barges. Table 4.1-10 presents the annual probabilities of spills from tank vessels calling at the Shell Terminal while transiting the San Francisco Bay. This equates to one spill every 710 years.

Table 4.1-10. Annual Probabilities of Spills from Vessels Calling at the Shell Terminal While Transiting the San Francisco Bay

Vessel Type		**Single Hull**	**Double Hull**	**All**
Tankers	Number of vessel calls	7	125	132
	Annual prob. of release	1.1×10^{-5}	1.1×10^{-4}	1.2×10^{-4}
Barges	Number of vessel calls	158	40	198
	Annual prob. of release	1.1×10^{-3}	2.0×10^{-4}	1.3×10^{-3}
Tankers and Barges	Number of vessel calls	165	165	330
	Annual prob. of release	1.1×10^{-3}	3.1×10^{-4}	1.4×10^{-3}
Source: Derived from data contained in USCG 1991.				

The distribution of a spill size greater than 238 bbls (10,000 gallons) for tankers and tank barges, given there is a spill, was derived from Cutter Information Corporation (1989). The distributions for tankers and tank barges are similar for smaller spills; however, the probability of a larger spill is higher for tankers because they can carry more oil (see Figure 4.1-4 above). The figure shows that the vast majority of spills are small. Unfortunately, the limitation of the Cutter database is that it does not include spills less than 238 bbls and hence, it is not possible to combine the spill distribution with the estimated probability of a spill.

Table 4.1-11 summarizes the expected number of spills per year from the Shell Terminal and tank vessels calling at the Shell Terminal while transiting the Bay. As can be seen from the table, the potential for a spill from the Shell Terminal, including the tank vessel while it is at the Shell Terminal, is much greater than the potential of a spill from a tank vessel transiting the Bay.

Table 4.1-11. Expected Number of Annual Spills from the Shell Terminal and Tankers Calling at the Shell Terminal While Transiting the Bay

Location	**Expect Number of Spills Annually**			
	> 1 Gal.	**> 100 Gal.**	**> 1,000 Gal.**	**> 42,000 Gal. (1,000 bbl)**
Terminal	0.70 (every 1.4 years)	0.21 (every 4-5 years)	0.08 (every 13 years)	0.013 (every 80 years)
Transiting Tankers		0.0014 (every 710 years)		

Consistent with the findings of the other resource disciplines in this ~~Draft~~ Final EIR, ~~it was~~ the CSLC concluded that, although the probability of a large spill is small, the consequences of a spill could be significant (see Section 4.2, Water Quality; Section 4.3, Biological Resources; Section 4.4, Commercial and Sport Fisheries; Section 4.5, Land Use and Recreation; and Section 4.9, Visual Resources). Based on the anticipated spills and on the impacts to resources, ~~it is~~ the CSLC concluded that the impact of spills would be adverse and significant and range from spills of 50 bbls or less that can be contained during first response efforts with rapid cleanup (Class II) to those larger or complex spills that result in a significant (Class I) impacts with residual effects after mitigation. Responses to tank vessel oil spills when not at the Shell Terminal are discussed below.

Tank Vessel Spills Within the Bay

Response to a spill from a tanker is the responsibility of the vessel owner/operator. Under the National Contingency Plan and National Incident Management System, a Unified Command would be formed, with the Federal On-Scene Coordinator (USCG Captain Of the Port) and the State On-Scene Coordinator (CDFG/OSPR) coordinating priorities, resources and efforts to protect the public, facilitate commerce, and mitigate the impacts of the spill. As a result of OPA 90, each vessel is required to have an oil plan that identifies the worst-case spill (defined as the entire contents of the vessel) and the assets that will be used to respond to the spill. The response capability of tanker companies and barge companies has not been analyzed in detail, but must be documented in their oil spill response manuals. All tanker companies operating within California waters must demonstrate by signed contract to the USCG and CDFG that they have, either themselves or under contract, the necessary response assets to respond to a worst-case release as defined under Federal and State regulations.

Response to a vessel spill would most likely consist of containment (deploying booms), recovery (deploying skimmers), and protection of sensitive resources. If the oil were to reach the shore and/or foul wildlife, the shoreline and wildlife would be ~~cleaned~~ assessed to determine what level, if any, of cleaning would present the least detrimental impacts. MSRC would make ~~their~~ its local equipment and manpower available. If required, additional equipment and manpower would be made available from local contractors, OSROs, and MSRC at other locations.

While MSRC can provide the equipment and manpower required by OPA 90 and OSPR, it is unlikely that they could prevent a large spill from causing significant contamination of the shoreline. The Regional Resource Manual and the Area Contingency Plan identify sensitive resources within the Bay Area and methodologies for protecting and cleaning up those areas. A large spill from a tank vessel can be classified as a significant, adverse (Class I) impact depending on spread of the spill and resources impacted as presented in other sections of this document.

Tank Vessel Spills Outside the Bay

Again, the vessel owner/operator is responsible for cleaning up spills and must be able to identify what assets will be used. Under the National Contingency Plan and the National Incident Management System, a Unified Command would be formed, with the USCG Captain Of The Port (Federal) and CDFG/OSPR (State) coordinating priorities, resources and efforts to protect the public, facilitate commerce, and mitigate the impacts of the spill. MSRC can provide the required response resources outside the Bay. The MSRC Oil Spill Contingency Plan and Area Contingency Plan identify sensitive resources along the outer coast and measures to be used in protecting these resources.

Response to spills outside the Bay would be somewhat different from that inside the Bay. First, the environment outside the Bay may be more difficult to work in because of sea conditions. Booms become less effective as wave heights increase, losing much of their effectiveness once waves exceed 6 feet. There may be conditions when it would be impossible to provide any response actions. However, when wave energy is such that it is impossible to deploy response equipment, the wave energy causes the oil to be dispersed much more rapidly.

Second, it may not be necessary to try to contain ~~and clean up~~ a spill if it does not threaten the shoreline or a sensitive area, although impacts upon sea life and navigation must be considered. In this case, the spiller would monitor the trajectory of the spill in accordance with methodologies presented in the Area Contingency Plan.

If the spill could affect the shoreline or sensitive area, then the response efforts would ~~consist of containing and cleaning as much oil as necessary, and protecting sensitive areas~~ be based upon assessments to determine what level, if any, of cleaning would present the least detrimental impacts.

The MSRC large response vessels are located inside the Bay. It would take the vessels a minimum of 2 hours to get underway and exit the Bay, and 24 hours to reach the Fort Bragg area. Again, additional resources would be available from other response cooperatives and other MSRC sites. While the response capability meets the minimum requirements of OPA 90 and OSPR, a large spill could still result in significant, adverse impacts (Class I) to sensitive resources as described in other resources sections of this document.

Mitigation Measures for OS-7:

OS-7a. Shell shall participate in U.S. Coast Guard (USCG) Ports and Waterways Safety Assessment (PAWSA) workshops for the San Francisco Bay area to support overall safety improvements to the ~~an analysis to determine the adequacy of the~~ existing Vessel Traffic Service ~~Tracking System~~ (VTS) in the Bay Area, if such ~~a~~ workshops ~~study is~~ are conducted by the USCG ~~a Federal, State, or local agency~~ during the life of the lease. ~~Shell shall designate a representative(s) to participate in this analysis toward the upgrade or expansion of the VTS per terms, including financial, to be agreed upon with other study participants.~~

OS-7b. Shell shall respond to any spill from a vessel traveling in the Bay to or from the wharf, moored at its wharf, related in any way to the wharf, or carrying cargo owned by Shell, as if it were its own, without assuming liability, until such time as the vessel's response organization can take over management of the response actions in a coordinated manner.

Rationale for Mitigation:

MM OS-7a: As presented above, the tanker owner/operator has responsibility for spills from ~~their~~ its tanker. Shell does not have any legal responsibility for tanker spills from vessels not owned or operated by Shell. Nevertheless, ~~as a participant in any analysis~~

~~to examine upgrades to the VTS, Shell can help to improve transit issues and response capabilities in general~~ Shell's participation in USCG PAWSA workshops for the San Francisco Bay area can help to improve transit issues and response capabilities in general, and will support overall safety improvements to the existing VTS in the future, which will help to reduce the potential for incidents and the consequences of spills within the Bay. ~~Agencies such as the San Francisco Bay Harbor Safety Committee and the USCG often conduct studies of safety issues within the Bay Area. As vessel traffic increases in and around the Bay Area and as technology improves, it may be necessary and feasible to upgrade and expand the VTS in and around the Bay Area.~~

For spills outside the Bay, all terminal and tanker/barge operators are required by Federal and State regulations to demonstrate that they have, or have under contract, sufficient response assets to respond to worst case releases. All terminals are under contract with one or more OSROs. These OSROs can provide all the necessary equipment and manpower to meet the requirements of existing regulations. Tankers and tank barges operating in U.S. and California waters must certify that they have the required capability under contract. However, oil spills can still result in significant, adverse impacts (Class I and Class II) to the environment depending on whether first response efforts can contain and cleanup the spill.

MM OS-7b: For a spill near the Shell Terminal, Shell is more suited to provide immediate response to a spill using its own equipment and resources, rather than waiting for mobilization and arrival of the vessel's response organization. The Shell Terminal staff is fully trained to take immediate actions in response to spills. Such action will result in a quicker application of oil spill equipment to any spill and improve control and recovery of such spill.

Residual Impacts: Even with these measures, the consequences of a spill could result in significant, adverse impacts (Class I).

4.1.5 Impacts of Alternatives

Impact OS-8: No Project Alternative

With no lease, there would be no potential for tanker spills at the Shell Terminal, a beneficial impact (Class IV). However, the potential for tanker spills would be transferred to other terminal in the Bay. Decommissioning of the Shell wharf would result in adverse, but less than significant impacts (Class III) associated with pipeline purging and removal.

Under the No Project Alternative, Shell's lease would not be renewed and the existing Shell Terminal would be subsequently decommissioned with its components abandoned in place, removed, or a combination thereof. The decommissioning of the Shell Terminal would follow an Abandonment and Restoration Plan as described in Section 3.3.1, No Project Alternative.

Under the No Project Alternative, alternative means of crude oil/product transportation would need to be in place prior to decommissioning of the Shell Terminal, or the operation of the Shell Refinery would cease production, at least temporarily. It is more likely, however, that under the No Project Alternative, Shell would pursue alternative means of traditional crude oil transportation, such as a pipeline transportation, or use of a different marine terminal. Accordingly, this ~~Draft~~ Final EIR describes and analyzes the potential environmental impacts of these alternatives. For the purposes of this ~~Draft~~ Final EIR, it has been assumed that the No Project Alternative would result in a decommissioning schedule that would consider implementation of one of the described transportation alternatives. Any future crude oil or product transportation alternative would be the subject of a subsequent application to the CSLC and other agencies having jurisdiction, depending on the proposed alternative.

During decommissioning of the Shell Terminal there could be a small risk of a spill during the pipeline purging and removal process that could be contained, however, the Shell Terminal contains the necessary equipment to contain and clean this type of spill and thus impacts are considered adverse, but less than significant (Class III).

Following decommissioning, with no Shell Terminal, there would be no potential for tanker spills at the Shell Terminal nor would there be potential for tanker fires or explosions at the Shell Terminal. The potential risk from the VCS would also be removed. With no Shell Terminal, operations would be transferred to other Bay Area marine terminals, with impacts similar to those discussed for the proposed Project. Thus, with no Shell Terminal there would be no potential for risk or safety impacts (Class IV).

OS-8. No mitigation is required.

Impact OS-9: Full Throughput Alternative

With no lease, similar impacts would occur or be transferred to other Bay Area terminals. Impacts from spills at those terminals would be adverse and significant, and range from spills that can be contained during first response efforts with rapid cleanup (Class II) to those complex spills that result in significant impacts (Class I) with residual effects after mitigation. Shell would have no responsibility for actions at those terminals.

The demand for crude oil at the nearby refineries is not expected to decrease. Hence, the crude oil would have to be imported in some other manner. This could be by tank vessel through other marine terminals and/or by pipeline. If the crude oil were imported through one or more marine terminals, the overall probability of an oil spill in the area would be expected to be approximately the same, and the sensitive resources in those areas could be impacted in the event of a release. However, the length of the pipelines connecting these marine terminals to the Shell Refinery would be longer, increasing the risk of a land-based pipeline release.

Replacement of Crude Oil Volumes via Pipeline

Pipeline spills of crude oil present less of an impact on the environment than tanker transportation spills. The probability of a spill is not necessarily less; however, the maximum amount of oil that can be released from a pipeline is generally less than that which can be released from a tanker. In addition, oil spilled on land generally causes less environmental impact than oil spilled on water.

Failure rates for pipelines are generally described in terms of spills per unit length per year and factor in pipeline characteristics of age, design, depth of burial, corrosion protection, wall thickness, and operating temperature. A failure rate range of 0.03 to 0.5 releases per year per 100 miles of pipeline has been cited in recent reports (Arthur D. Little 1986; Pacific Pipeline Company 1991; U.S. Department of Agriculture [USDA] 1991; Aspen Environmental Group 1996). Aspen, based on an analysis of pipeline spill statistics including the above referenced reports, presented the following spill estimates for pipelines with diameters greater than 16 inches:

Leaks:
- 0.08 per 100 miles per year for pipelines 40 years or older;
- 0.03 per 100 miles per year for “existing” pipelines (approximately 20 years old);
- 0.012 per 100 miles per year for “new” pipelines (in first 10 years).

Ruptures:
- 0.04 per 100 miles per year for “old” pipelines;
- 0.016 per 100 miles per year for “existing” pipelines;
- 0.006 per 100 miles per year for “new” pipelines.

A leak is defined as a relatively small rate of release from a pipeline. A typical cause would be a small hole that results in corrosion pitting, a leaking flange, or valve. A rupture represents a relatively high rate of release as might occur if the pipe were breached by an external force.

The maximum spill volume is a combination of drainage potential and the pumping rate for the period of time before the breached segment can be isolated. Worst-case calculations of spill volumes are normally based on the assumption of complete drainage by gravity of the section of pipe between high ground and the point of rupture (called drainage volume). Additional spillage depends on the flow rate and response time to shut down the pipeline. Analysis of drainage volume assumes that the drainage will be complete. This may not necessarily be the case because: (1) the breach may be less than a full rupture, (2) a block valve within the affected pipe section may be successfully closed before complete evacuation occurs, or (3) a check valve in an uphill stretch can prevent backflow of oil between high ground and the valve. The gradient of the terrain determines the hydrostatic force available to evacuate the pipe after the pumps are turned off. Evacuation will take much longer in nearly flat terrain. The average spill size from 16-inch-diameter crude oil pipelines, as reported to OSPR between 1980 and 1990, was 2,680 bbls (USDA 1991). This is the volume in 2 miles of 16-inch pipe.

The pipeline that Shell just recently purchased would have to transport oil approximately 22 miles from a marine terminal in the Richmond/San Pablo Bay area to the Shell Refinery. Based on the probability estimates previously discussed, the annual probabilities of a leak and rupture ~~of~~ would be 0.7 percent and 0.4 percent, respectively. In addition, damage could occur to other nearby pipelines during the process or constructing additional pipeline sections needed to connect between the marine terminals and the Shell Refinery. A leak or rupture could result in a significant, adverse (Class I) impact where sensitive resources are affected. Class II impacts could occur in areas that can be contained and cleaned up (such as roadways).

Crude Intake via Other Marine Terminals

This alternative would shift the risk associated with crude intake at the Shell Terminal to other Bay Area terminals. This could either slightly increase or decrease the risk, depending on the characteristics and locations of the terminals used. Characteristics that could alter the risk include:

- Tankers would travel a shorter distance to reach these other terminals, since they are located closer to the Bay entrance;
- The added tanker traffic at these terminals may create congestion and increase the risk for a collision or other incident;
- The other terminals may have a different (better or worse) level of spill response; and
- Use of these other marine terminals would require application of mitigation measures comparable to the mitigation for the proposed Project because there would likely be a lease renewal or permit modification for the change/increase in operation.

In addition to the above, new pipelines may have to be constructed from these terminal(s) to the Shell Refinery. As stated above, the transportation of crude oil by pipeline does have the potential for releases and the potential to damage other pipelines during construction. A leak or rupture would result in a significant, adverse (Class I) impact where sensitive resources are affected. Class II impacts could also occur in areas that can be contained and cleaned up (such as roadways). Shifting the input to other terminal(s) would most likely increase the overall risk of a spill slightly, due to the increased congestion and increase the risk for a collision or other incident.

Product Export via Other Marine Terminals

As with crude oil discussed above, using other marine terminals to export products would shift the potential risk to the other terminals with the same advantages and disadvantages discussed for crude oil import. The fact that there are many different products to be exported complicates the process and may slightly increase the risk. Shell would either have to build multiple pipelines to handle all of the various products or ship the products in batches through a single line. Batching the products may require additional tanks to be built at the other terminals to temporarily store the products. This would increase the handling and potential for spills. Depending on whether a spill could be contained and cleaned up with no residual effects, impacts would be considered either Class I or Class II.

<u>Mitigation Measures for OS-9</u>:

OS-9a. Mitigation described for the proposed Project (MM OS-3 through MM OS-7), would be required at other terminals. It is unknown at this time whether such measures are in place at other terminals.

OS-9b. Mitigation for new and existing pipelines includes that presented in MM GEO-8, adhering to proper engineering design, inspection, maintenance, and retrofitting.

<u>Rationale for Mitigation</u>: As with the proposed Project, the mitigation applied to the other terminals would lower the probability of spills and increase response capabilities at the other terminals. The mitigation applied to the pipelines would lower the probability of spills.

<u>Residual Impacts</u>: Impacts associated with the Shell Terminal would be reduced, but impacts from the pipelines and other terminals would increase and have the potential to remain significant (Class I). Impacts from the pipelines would remain significant (Class I) for a large spill to land resources.

4.1.6 Cumulative Projects Impact Analysis

Impact CUM-OS-1: Upset Conditions

All terminals and tanker/barge operators are required by Federal and State regulations to demonstrate that they have, or have under contract, sufficient response assets to respond to worst-case releases. Even so, oil spills can still result in significant, adverse impacts (Class I and Class II) to the environment depending on whether first response efforts can contain and cleanup the spill. Shell contributes incrementally to the cumulative environment.

Spills from a Marine Terminal

As discussed in Section 4.1.1, Environmental Setting, a total of ~~128~~ <u>159</u> spills have occurred from marine terminals in the San Francisco Bay between 1992 and ~~2002~~ <u>2005</u>. The potential exists for spills at all marine terminals operating within the Bay. The actual probability varies depending on the design and operational procedures in place. The potential impacts of spills vary depending on the location of the terminals and the response equipment and procedures available.

Spills from Tankering Inside and Outside the Bay

Chambers Group (1994) used data from the Marine Exchange (1992), CSLC (1992), USACE (1990), USCG (1991), and nautical charts to estimate tanker and barge traffic within the Bay. Based on the amount of tanker and tank barge traffic along the various routes within the Bay, cumulative probabilities of a spill were developed for various sections within the Bay. These probabilities were then used to conduct the probabilistic oil spill modeling for cumulative tanker and tank barge traffic within the Bay.

The expected mean time between spills for all tanker and tank barge traffic inside the Bay for three minimum size spills is presented in Table 4.1-12. Based on estimated mileage traveled within the Bay, vessel traffic associated with the Shell Terminal is approximately 5 percent of the total probability of a spill from tanker and tank barge traffic in the Bay.

Chambers Group (1994) also used data from the Marine Exchange that listed the last and next ports of call for all tankers calling at marine terminals in the San Francisco Bay Area to estimate the number of annual tanker trips along various routes outside the Bay. The expected mean time between spills outside the Bay is also shown in Table 4.1-12.

Table 4.1-12. Expected Mean Time Between Spills Inside and Outside the Bay – All Tank Vessels

Spill Size (bbls)	Expected Mean Time Between Spills (Years)	
	Inside Bay	**Outside Bay**
238	36	Not calculated
1,000	48	42
10,000	238	123

~~*Spills from Tankering Outside the Bay*~~

~~Chambers Group (1994), using data from the Marine Exchange which listed the last and next port of call for all tankers calling at marine terminals in the San Francisco Bay Area, estimated the number of annual tanker trips along various routes outside the Bay. The expected mean time between spills outside the Bay is shown in Table 4.1-13.~~

~~Table 4.1-13. Expected Mean Time Between Spills Outside the Bay – All Tank Vessels~~

~~Spill Size (bbls)~~	~~Expected Mean Time Between Spills (Years)~~
~~1,000~~	~~42~~
~~10,000~~	~~123~~

Spill Response

An impact on spill response capability could occur if there were two or more spills at the same time; however, the probability of this is extremely small. Having many marine terminals and extensive vessel traffic in the Bay tends to increase the total amount of spill response equipment and services available.

All terminals and tanker/barge operators are required by Federal and State regulations to demonstrate that they have, or have under contract, sufficient response assets to respond to worst case releases. All terminals are under contract with one or more OSROs. These OSROs can provide all the necessary equipment and manpower to meet the requirements of existing regulations; however, oil spills can result in significant, adverse impacts (Class I and Class II) to the environment depending on whether first response efforts can contain and cleanup the spill. Tankers and tank barges operating in U.S. and California waters must certify that they have the required capability under contract. Shell contributes cumulatively to this impact.

Mitigation Measures for CUM-OS-1:

CUM-OS-1. Mitigation for Shell remains as described for the proposed Project, implementation of MMs OS-3 through OS-7.

Rationale for mitigation: Implementation of mitigation measures similar to MM OS-3 through MM OS-7 at all terminals would provide for increases in response capability and the lowering of the probability of accidents. However, each terminal would require individual evaluation of potential for impacts. These measures can reduce the consequences of small spills near a terminal that can be quickly contained and cleaned to less than significant. Shell contributes incrementally to the cumulative environment.

Residual Impacts: Even with mitigation applied, risk of oil spills, typically larger than 50 bbls, could result in environmental impacts that remain significant (Class I).

Table 4.1-13~~4~~ provides a summary of the Operational Safety/Risk of Accidents impacts and mitigation measures.

Table 4.1-13~~4~~. Summary of Operational Safety/Risk of Accidents Impacts and Mitigation Measures

Impact	Mitigation Measures
OS-1: Shell Terminal Deck Drainage System	No mitigation required.
OS-2: Gasoline and Other Highly Volatile Product Releases	No mitigation required.
OS-3: Class I-IV Oil Spills from Terminal During Transfer Operations	**OS-3a:** Provide ~~mooring quick release devices~~ and maintain Remote Release Systems that would allow a vessel to leave the Shell Terminal ~~in as~~ quickly ~~as possible~~ in the event of an emergency.
	OS-3b: Install and maintain integrated Tension Monitoring Systems to effectively monitor all mooring line and environmental loads in real-time, with alarms and preset limits ~~devices to continuously monitor moored vessels' movements in real time and install alarm system~~.
	OS-3c: Install and maintain integrated Allision Avoidance Systems (AASs) to effectively monitor all vessel approaches/impacts during berthing operations and vessel drift during mooring operations ~~if required by CSLC in consultation with USCG and Bar Pilots~~.

Table 4.1-13~~4~~. Summary of Operational Safety/Risk of Accidents Impacts and Mitigation Measures

Impact	Mitigation Measures
OS-4: Group V Oils	**OS-4:** Shell shall ~~not handle~~ consult with the CSLC staff regarding Group V ~~until it has installed the required Group V~~ oil spill response technology and work with CSLC in applying the new technologies ~~mitigating equipment and incorporated the specific response procedures into its Oil Spill Pollution Prevention and Response Plan~~.
OS-5: Terminal Spills from Pipelines during Non-Transfer Periods	No mitigation required.
OS-6: Fires and Explosions	**OS-6a:** Implement MM OS-3a.
	OS-6b: Develop and implement a Fire Plan~~, including a set of procedures, training and drills consistent with~~ MOTEMS and procedures for dealing with tank vessel fires and explosions for tankers berthed at the Shell Terminal, including conducting training and drills.
OS-7: Response Capability for Accidents in Bay and Outer Coast	**OS-7a:** Shell shall participate in USCG PAWSA workshops for the San Francisco Bay area to support overall safety improvements to the existing VTS, if such workshops are conducted by the USCG during the life of the lease. ~~Participate in an analysis to determine the adequacy of the existing VTS in the Bay Area and contribute a pro-rata share toward the upgrade and expansion of the system.~~
	OS-7b: Agree to respond to spills from tankers in the Bay at or near the Shell Terminal until such time as the vessel's response organization can take over management of the response actions.
OS-8: No Project Alternative	No mitigation ~~is~~ required.
OS-9: Full Throughput Alternative	**OS-9a:** No mitigation required for Shell Terminal, however other terminals would need mitigation similar to the proposed Project (MM OS-3 through MM OS-7).
	OS-9b: Application of MM GEO-8 for pipelines.
CUM-OS-1: Upset Conditions	**CUM-OS-1:** Implement MM OS-3 through MM OS-7.